GENUS *STIZUS* LATREILLE IN NORTH AMERICA (HYMENOPTERA: NYSSONINAE)

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ABSTRACT. The five North American species of *Stizus* Latreille are reviewed. *Stizus aztecus* is described, and new descriptions are provided for the other four species: *S. brevipennis* Walsh, *S. texanus* Cresson, *S. occidentalis* Parker, and *S. iridis* Dow. A key to these species is provided, and the distribution of each species is documented. The North American species belong to two well-defined species-groups, the *brevipennis* group and the *ruficornis* group, and the characters defining these two groups are discussed. The ethology of *Stizus* is reviewed, and a worldwide list of the published prey records is presented.

INTRODUCTION

The species belonging to the genus *Stizus* are large, often brightly colored, ground-nesting wasps that provision their nests with Orthoptera. With more than 120 species now recognized, *Stizus* is one of the largest genera in the Nyssoninae with only the cosmopolitan genera *Bembecinus* and *Bembix* containing more species. *Stizus* is widespread in Africa, Eurasia, and North America but is absent from Australia and the Americas south of Mexico. The vast majority of species occur in the Old World, and only five species are known from North America: *S. brevipennis* Walsh, *S. texanus* Cresson, *S. aztecus* new species, *S. occidentalis* Parker, and *S. iridis* Dow. The North American species fall into two well-defined species groups, the *brevipennis* group which is restricted to North America and the *ruficornis* group which is well developed in Africa and Eurasia. Two other species groups are also recognized but do not occur in North America, the very large *fasciatus* group with numerous species in the Old World and the monotypic *scolaeformis* group of Africa.

The present work provides a review of what is now known about the North American species of *Stizus*, including their taxonomy, distribution, and ethology. A new species, *S. aztecus*, is described, and each of the previously known species is redescribed in order to remedy certain deficiencies in earlier descriptions and to facilitate comparisons between species. The male genitalia and sternum VIII of each species are illustrated with SEM photographs; these structures differ markedly between species and provide a reliable basis for identification. The characters serving to distinguish the *brevipennis* and *ruficornis* groups are discussed, and a key to the North American species is provided. It is unlikely that any new species will be discovered in North America, but much remains to be learned about the biology of *Stizus*. Prey records, for example, exist for only two of the five North American species and only eleven of the more than 100 species occurring in the Old World. Even less is known about the nesting behavior of *Stizus*; only the East Asian *S. pulcherrimus* has been studied in much detail (Tsuneki, 1965). A worldwide list of prey records for *Stizus* is provided here, and Evans (1966) may be consulted for a general review of *Stizus* ethology.

A sizeable, though rather scattered, literature devoted to *Stizus* has developed since the classical monograph of Hand-

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lirsch (1892) which treated the genus on a global scale. At that time, only two species were known from North America, *S. brevipennis* Walsh (1869) and *S. texanus* Cresson (1872), and several decades were to pass before Parker (1929) described *S. occidentalis*. Dow (1941) added *S. iridis* and provided the first comprehensive key to the North American species. The world monograph of Handlirsch (1892) provided a firm foundation for further work on *Stizus* taxonomy and is a valuable source of information even today. The more recent literature is much narrower in scope but includes several important regional works, including Mercet (1906) for Spain, Mochi (1939) for Egypt, Bingham (1897) for India, and Arnold (1929, 1945) for southern Africa and Madagascar. There is a need for a comprehensive review of the Old World *Stizus* with an eye toward developing a clearer view of subgeneric relationships. Valuable discussions of the systematics of *Stizus* and related genera have been provided by Lohrmann (1943), de Beaumont (1954), Evans (1966), and Bohart and Menke (1976). This last work includes a comprehensive list of the known species. The morphological terminology employed here follows Bohart and Menke (1976) or, in some cases, Evans (1966).

The genus *Stizus* was interpreted in a very broad sense by such early authors as Handlirsch (1892), Fox (1895), Kohl (1897), and, most recently, by Arnold (1929, 1945). As understood by these authors, *Stizus* included two components which have been generally regarded as distinct genera following Parker (1929): *Stizoides* Guérin-Méneville and *Bembecinus* A. Costa. These genera agree with *Stizus* in many respects and are generally considered to be closely related. *Stizoides* is clearly very close to *Stizus* but differs in having edentate mandibles, eyes that converge strongly below, and a strongly sculptured integument. The distribution of *Stizoides* is very similar to that of *Stizus*; the 28 species now recognized are restricted to Africa and Eurasia except for two North American species. *Bembecinus* represents a more divergent element as indicated by the following derived characters that serve to distinguish it from *Stizus* and *Stizoides*: 1) male antenna with a spinose projection on flagellomere IX in most species; 2) episternal-scrobal sulcus absent, the mesopleuron not interrupted by any grooves or ridges; 3) propodeum concave behind, compressed into ridges posterolaterally; 4) second submarginal cell markedly narrowed anteriorly and sometimes petiolate; and 5) hindwing median cell with only one distal appendage instead of two. The roughly 150 species currently recognized in *Bembecinus* include representatives in all major regions. *Stizoides* and *Bembecinus* both lack the median pubescent depression on the female scutellum as found in many *Stizus*.

The behavioral information now available strongly supports this generic classification (Evans, 1966). *Stizus* provisions with Orthoptera (and rarely, perhaps, with cicadas, see Table 1) while *Bembecinus* preys upon small Homoptera (Cicadoidea except cicadas, Fulgoroidea, and, rarely, Psylloidea). Most, if not all gorytine wasps also employ homopteran prey, and the use of such prey by *Bembecinus* may well represent the retention of the primitive prey preference. *Stizoides*, on the other hand, is a cleptoparasite of sphecids that prey upon Orthoptera, including the genera *Palmodes*, *Prionyx*, and *Sphex*. *Stizus* and *Bembecinus* further differ in that the former oviposits on the first prey item in each cell and employs mass provisioning, while the latter oviposits on a mound of soil in the empty cell and practices progressive provisioning.

Most recent authors have treated *Stizus*, *Stizoides*, and *Bembecinus* as comprising the tribe Stizini which is generally regarded as being more or less intermediate between the Gorytini and the Bembicini. There can be little doubt that the Stizini and the Bembicini are closely related since they uniquely share a number

of clearly derived characters, including: 1) forewing with basal vein reaching subcosta far basad of the pterostigma so that the prestigmal portion of the first submarginal cell is longer than the distance between the marginal cell and the apex of the wing; 2) scutellum with a lamellate posterior border that broadly overlaps the metanotum which is thus hidden laterally; and 3) male tergum VII with basolateral spiracular lobes (absent in the bembicin genera *Bicyrtes* and *Microbembex*). These characters are considered to be derived because they occur in no other sphecoid wasps including those generally considered to be most primitive. The only exception is the presence of well-developed spiracular lobes in the African genus *Handlirschia* (Bohart and Menke, 1976) now assigned to the Gorytini but perhaps more closely related to the Stizini than has been generally recognized. The Stizini are distinguished from the Bembicini by the presence of certain primitive characters in the former, notably: 1) labrum distinctly wider than long; 2) ocelli normal; and 3) midtibia with two spurs (except in some *Stizoides*). I have been unable to find any clearly derived characters that would uniquely associate the Stizini, and it is probable that this tribe should be combined with the Bembicini.

A few genera included in the Gorytini bear a more or less striking resemblance to the Stizini in that they are relatively large wasps of robust proportions with a notably compact mesosoma. In some cases, as in *Sphecius*, the resemblance extends to such features as a prominent and fully exposed labrum, very small pterostigma, and a smoothly curved episternal-scrobal sulcus. Although these are apparently derived characters in the Nyssoninae, they are known to have arisen more than once in the Sphecoidea, and their presence in some Gorytini and the Stizini may represent parallel developments rather than shared ancestry. In any event, *Sphecius* is the only gorytin genus in North America that is likely to be confused with *Stizus* but can be readily separated by the presence of a well-defined omaulus and a much shorter first submarginal cell.

I have examined material from the following collections which are here provided with abbreviations in order to facilitate subsequent reference: American Museum of Natural History (AMNH), Bee Biology and Systematics Laboratory, USDA, Logan, Utah (BBSL), Los Angeles County Museum of Natural History (LACM), Museum of Comparative Zoology (MCZ), Philadelphia Academy of Natural Science (PAS), Texas A&M University (TA&M), United States National Museum (USNM), University of California at Davis (UCD), University of California at Riverside (UCR), and my personal collection (JWS).

Genus *Stizus* Latreille

Stizus Latreille, 1802–1803, Hist. Nat. Gen. Partic. Crust. Ins. **3:** 344. Type species: "*Stizus ruficornis* Fabr." [=*Larra ruficornis* of Fabricius, 1804, = *Bembex ruficornis* Fabricius, 1787, = *Vespa ruficornis* Forster, 1771] designated by Blanchard, 1846: pl 121. Synonymy after J. van der Vecht, 1959, Ent. Ber. **19:** 68–69; this species should be referred to as *Stizus ruficornis* (Forster) rather than *Stizus ruficornis* (Fabricius) as it has usually been written. Most authors, including Pate, 1937, have accepted Latreille, 1810, as a type-designation for *Stizus*, but see Bohart and Menke, 1965, Bull. zool. Momencl. **22:** 255–256 and Bohart, 1966, Bull. zool. Nomencl. **23:** 7–8.

1803 Latreille, Hist. Nat. Gen. Partic. Crust. Ins. **5:** 309.

1805 Latreille, Hist. Nat. Gen. Partic. Crust. Ins. **13:** 302 (in part).

1809 Latreille, Genera Crust. et Ins. **4:** 100 (in part).

1810 Latreille, Considér. génér. p. 321 (in part).

1846 Blanchard, Hyménoptères, pp. 113–227 (vol. 13), pls. 107–129 (vol. 14). *In* G. Cuvier, La Regne Animal etc. Fortin, Masson et Cie, Paris.

1892 Handlirsch, Sitzber. k. Akad. Wiss. Wien, Math. -nat. Classe, Abt. 1, **101**(1): 25–205, 3 pls. (in part).

1895 Fox, Proc. Acad. Nat. Sci. Philadelphia 1895: 264–268 (in part).

1897 Kohl, Ann. k. k. Naturhist. Hofmus., Wien **11:** 269, 421–424, pls. VI, VIII–X (in part).

1897 Bingham, Fauna British India. Hymenoptera **1:** 276–277 (in part).

1897 Dalla Torre, Cat. Hym. **8:** 519–534 (in part).
1906 Mercet, Mem. Real. Soc. Española Hist. Nat. **4:** 142–158 (in part).
1917 Mickel, Nebraska Univ. Studies **17**(4): 432–435 (in part).
1925 Berland, Faune de France **10:** 78 (in part).
1929 Arnold, Ann. Transvaal Museum **13:** 217, 260–319 (in part).
1929 Parker, Proc. U.S. Nat. Museum **75**(5): 5, 9–10, figs. 1, 2, 29.
1937 Pate, Mem. Amer. Ent. Soc., No. 9: 62, 85–86.
1939 Mochi, Bull. Soc. Fouad 1er d'Ent. **23:** 183–237 (in part).
1942 Dow, Psyche **48:** 171–181.
1943 Lohrmann, Mitt. Münchn. Ent. Ges. **33:** 189, 203–205.
1945 Arnold, The Sphecidae of Madagascar, pp. 68–78 (in part).
1951 Krombein, *in* Muesebeck *et al.*, Hym. of Amer. North of Mexico, Synoptic Catalog, p. 993.
1954 de Beaumont, Rev. Suisse Zool. **61**(8): 295, 313.
1955 Bytinski-Salz, *in* de Beaumont and Bytinski-Salz, Bull. Res. Counc. Israel B **5:** 32–60.
1966 Evans, Comparative Ethology and Evolution of the Sand Wasps, pp. 117–118, figs. 63–68.
1971 Tsuneki, Acta. Zool. Acad. Sci. Hungaricae **17:** 202–207, figs. 57–83.
1976 Bohart and Menke, Sphecid Wasps of the World, pp. 53, 525–527.
1979 Krombein, *in* Krombein *et al.*, Catalog of Hym. in Amer. North of Mexico, vol. 2, p. 1702.

Larra Fabricius *sensu* Klug, 1845, Insecta, decas quinta, pl. 46 and unnumbered text pages, *in* vol. 2 of C. G. Ehrenberg, 1828–1845, Symbolae physicae, seu icones et descriptiones corporum novarum aut minus cognitorum, etc. 4 vol., Barolini, Reimeri (in part).

Larra Fabricius *sensu* F. Smith, 1856, Cat. Hym. British Museum **4:** 337 (in part).

Megastizus Patton, 1897, Bull. U.S. Geol. Survey Terr. **5:** 344–345. Type species: *Stizus brevipennis* Walsh, 1869, by original designation.
1887 Cresson, Synopsis, Trans. Amer. Ent. Soc. Suppl., pp. 115, 278.
1899 Ashmead, Canad. Ent. **31:** 347.

Stizolarra Saussure, 1887, Soc. Ent. Zurich **2:** 9. Type species: *Sphex vespiformis* Fabricius, 1775, designated by Pate, 1937, p. 62.

Megalostizus Schulz, 1906, Spolia Hymenopterologica p. 199. Emendation of *Megastizus* Patton, 1879.

Generic Diagnosis: Maxillary palpi with six and labial palpi with four segments; mandible with single inner subapical tooth; labrum exposed, moderately convex, approximately semicircular in outline, plainly wider than long; male antenna without a projection on flagellomere IX; inner margins of compound eyes subparallel, only slightly converging below; ocelli normal. Mesopleuron with a smoothly curved episternal-scrobal sulcus, precoxal sulcus often evident, otherwise without ridges or grooves; scutum with oblique scutal carinae; scutellum with lamellate posterior margin overlapping metanotum; scutellum in female often with a median pubescent depression; propodeum evenly rounded posterolaterally, not compressed into ridges, spiracular groove absent. Foretarsal rake present in female; midtibia with two apical spurs. Forewing with three submarginal cells, the second not petiolate; basal vein arising before cubito-anal crossvein, joining subcosta far basad of pterostigma, first submarginal cell much longer than marginal cell. Hindwing media arising far basad of cubito-anal crossvein; median cell with two distal appendices. Tergum VII of male with large lateral lobes containing spiracles; sternum VIII of male with three distal prongs.

Generic Description: This description has been prepared as a summary of the characters shared by the North American species and may not apply in all details to members of the Old World fauna.

Male. Form robust; size large to very large (16 to 33 mm), larger than both *Stizoides* and *Bembecinus.*

Head, in facial view, wider than long (greatest width versus median length from vertex to anterior margin of clypeus), narrower than thorax. Maxillary palpus with six and labial palpus with four segments; mandible with a single inner subapical tooth; labrum exposed, moderately convex, distinctly wider than long; clypeus convex, wider than long, separated from antennal sockets by more than intersocketal distance. Supraclypeal area convex with apex of convexity near subantennal line; interantennal area with a low median ridge, often carinate posteriorly; supraantennal area with a longitudinal median depression that often surrounds the median ocellus, bordered above to each side

by more or less distinct convexities. Antennae long, reaching posterior face of propodeum, only slightly enlarged distally; scape about twice as long as greatest width; antenna with thirteen segments, flagellomeres with or without linear carinate tyloids, without a projection on flagellomere IX. Compound eyes nearly reaching clypeus, little separated from base of mandible, inner margins subparallel, only slightly converging below. Ocelli unmodified; bulge present between median ocellus and each lateral ocellus raising anterior margin of each lateral ocellus above its posterior margin.

Mesosoma robust, with sclerites smoothly confluent; pronotum short; notauli usually not evident, occasionally indicated by faint impressions; parapsidal lines and well-separated admedian lines usually present but often poorly developed and sometimes not evident; mesonotal laminae broad, each marked posteriorly by oblique scutal carina delimiting a concave declivity; metanotum hidden laterally by scutellum but in fact continuous to metapleura, with a reflexed lamelliform process along posterior margin of wing insertion; propodeum rounded posterolaterally, flattened behind; mesopleuron with well-defined episternal-scrobal sulcus forming a smoothly curved arc; omaulus, acetabular carina, and sternaulus absent. Legs without pecten on foretarsi; midtibia with two apical spurs; arolia prominent, extending to or somewhat beyond basal half of claws, subequal on all legs. Forewing with pterostigma small, not as wide as costal cell; basal vein arising basad of cubito-anal crossvein and reaching subcosta far basad of the pterostigma; first submarginal cell about twice as long as marginal cell; second submarginal cell narrower anteriorly but not petiolate, receiving both recurrent veins. Hindwing with media diverging far basad of cubito-anal crossvein, median cell with two distal appendices.

Gaster robust, with seven visible terga; tergum VII with large spiracular lobes; tergum VIII simple, without lateral lobes, hidden beneath tergum VII; sternum I with a prominent longitudinal carina basally; sternum VII exposed, centrally sclerotized with a membranous border; sternum VIII stout, with three strong distal prongs; genitalia with digitus much exceeding cuspis.

Puncturation similar in all North American species; distinctly punctate under low magnification, upper frons and mesosoma (especially propodeum) rather coarsely so; labrum, clypeus, supraclypeal area, occiput, pronotum, and gaster very finely punctate.

Vestiture consisting of scattered to rather dense long hairs; appressed pubescence also present over much of body in some species and in others restricted to legs, tegulae, sclerites at base of wing, and larger veins.

Coloration variable, ranging from mostly black with yellow markings, as in *S. brevipennis*, to mostly yellow with ferruginous and black markings, as in *S. iridis*; the other North American species exhibit various combinations of black, ferruginous, and yellow.

Female. Similar to male; antenna with twelve segments; scutellum often with a median pubescent depression (poorly developed or absent in members of the *brevipennis* group); foretarsal rake well developed, forebasitarsus with six stout apical bristles; gaster with six visible terga, with or without a well-defined pygidial area on tergum VI.

Larva. Evans (1964, pp. 255–257, pl. 11, figs. 26–30) has described the larva of *Stizus pulcherrimus* (Smith) from portions of a cast larval skin extracted from a cocoon. Apparently, no other information is available on the larval morphology of *Stizus*. According to Evans, the larva may be briefly characterized as follows: Sides of apical margin of labrum with only some weak, barely protruding bristles; oral surface of prementum papillose; spinules in median portion of epipharynx directed basad, the sides of the epipharynx par-

TABLE 1. PREY RECORDS FOR SPECIES OF *Stizus*.

Species and notes	Prey	Source
1. *atrox* Smith (=*pentheres* Handlirsch) South Africa	Orthoptera nymphs	Brauns, 1911
2. *berlandi* Arnold Madagascar; unspecified number of females taken with prey	Acrididae ? "various species of grasshoppers"	Arnold, 1945
3. *brevipennis* Walsh Kansas; single female observed hunting	Tettigoniidae *Conocephalus* sp. (=*Xiphidium* sp.)	Williams, 1914
4. *chrysorrheous* Handlirsch South Africa	Orthoptera nymphs	Brauns, 1911
5. *dewitzii* Handlirsch South Africa	Orthoptera nymphs	Brauns, 1911
6. *fasciatus* (Fabricius) Corsica	Acrididae Acridinae *Chorthippus bicolor* Charp. Calliptaminae *Calliptamus italicus* Linn. Cyrtacanthacridinae *Pezotettix giornae* Rossi	Ferton 1899, 1902a,b 1909
fasciatus (Fabricius) Spain	Acrididae Acridinae *Stauroderus vagans* Eversman	Bernard, 1934
fasciatus (Fabricius) Israel; aggregation of more than 100 nests with females carrying stated prey	Acrididae Calliptaminae *Calliptamus* sp.	Bytinski-Salz, 1955
7. *fuscatus* Morice Libya; single female taken with prey	Acrididae "3d instar desert locust"; presumably *Schistocerca gregaria* Forskål (Cyrtacantharidinae)	de Beaumont, 1956
8. *imperialis* Handlirsch South Africa	Acrididae (mostly)	Brauns, 1911
9. *iridis* Dow Utah; two nests excavated	Acrididae Oedipodinae *Trimerotropis pallidipennis* (Burmeister) *Trimerotropis sparsa* (Thomas)	Dow, 1976
10. *marshalli* Turner Zimbabwe (Southern Rhodesia)	Mantidae	Dow, 1935
11. *pulcherrimus* (Smith) Japan	Acrididae Acridinae *Aiolopus tamulus* Fab.	Katayama, 1933
pulcherrimus (Smith) East Mongolia; single nest studied	Acrididae Acridinae *Chorthippus dubius* Zub.	Tsuneki, 1943a, 1965
pulcherrimus (Smith) Korea; 15 nests excavated containing 118 prey items, the most detailed behavioral study yet to appear	Acrididae Acridinae *Acrida lata* Motschulsky *Aiolopus tamulus* Fab. *Parapleurus alliaceus* Germar *Stauroderus schmidti* Ikonnikov	Tsuneki, 1943b, 1965

TABLE 1. CONTINUED.

Species and notes	Prey	Source
	Oedipodinae *Trilophidia annulata* Thunberg Cyrtacanthacridinae Sp. near *Oxya vicina* Brunner Tettigoniidae Conocephalinae *Conocephalus maculatus* Zub.	
12. *rufescens* (Smith) India; single female observed with prey, a questionable record	"small cicada"	Bingham, 1897
13. *ruficornis* (Forster) (=*ruficornis* Fabricius) France	Mantidae *Mantis religiosa* Linn. and other mantids	Fabre, 1886
ruficornis (Forster) (=*distinguendus* Handl.) La Camargue, France; several nests studied	Mantidae *Mantis religiosa* Linn. *Empusa egena*	Deleurance, 1941

tially pigmented; mandibles tridentate, middle tooth very large, blunt, and close to the apical tooth; body with restricted transverse rows of large, darkly pigmented spines. Evans further notes that the arrangement of the median epipharyngeal spinules and the presence of a stout preapical tooth on the mandible set *Stizus* apart from all other nyssonines and are suggestive of similar structures in the Sphecinae. He suggests that this unexpected resemblance may be associated with the use of orthopteran prey in both *Stizus* and many sphecines.

Distribution: Stizus is widely distributed in the Ethiopian, Palearctic, and Nearctic Regions but is apparently absent from the New World south of central Mexico, Southeast Asia, Australia, and the islands of Oceania. Of the more than 120 species currently recognized in *Stizus*, only five are known from North America where they are largely restricted to arid or semiarid regions, the principal exception being *S. brevipennis* which is widely distributed in the Austral Zone east of the Rocky Mountains. The other North American species are restricted to the western half of the continent.

Behavior: Behavioral information on *Stizus* is very limited. Only the East Asian *S. pulcherrimus* (Smith) has been studied in some detail (Tsuneki, 1943a,b, 1965). Dow (1976) has provided the only report on the nesting behavior of a North American species. Evans (1966) has thoroughly reviewed the behavioral literature on *Stizus*. To judge from existing accounts, the nesting behavior of *Stizus* may be briefly summarized as follows. The nests are constructed in the ground and consist of a main burrow ending in one or more brood cells. Often a number of females will nest in close proximity and such nesting aggregations are sometimes quite large; Bytinski-Salz (1955) has reported an aggregation of more than 100 nests of *S. fasciatus* in Israel. The nest entrance is closed when the wasp is away, and false burrows, which are thought to deter parasites, are sometimes constructed near the true nest entrance (Tsuneki, 1965). The egg is laid on the first prey item before the rest of the prey are brought in, and the larva may reach a considerable size before provisioning is completed (Tsuneki, 1965). Such provisioning behavior may be viewed as transitional between mass provisioning and true progressive provisioning. Miltogrammine sarcophagids, rhipiphorid beetles,

and mutillid wasps are reported parasites (Evans, 1966). In all certain cases, *Stizus* has been found to use orthopteran prey; grasshoppers, katydids, and mantids have all been reported. Bingham (1897: 277) reported, however, that he observed a female of *S. rufescens* (Smith) with a small cicada, but, in view of the other evidence, this record must be considered doubtful and in need of confirmation. One might suppose that Bingham actually saw a member of the superficially similar genus *Sphecius* which is well known to hunt cicadas, but Bohart and Menke (1976) do not list any *Sphecius* from India where Bingham made his observation. Table 1 lists all the prey records for *Stizus* that have come to my attention and can serve as a guide to the literature on the biology of *Stizus*.

Species Groups: Four species groups are currently recognized in *Stizus*, the *fasciatus*, *ruficornis*, *brevipennis*, and *scolaeformis* groups. The first three date from the world monograph of Handlirsch (1892) which treated *Stizus* in a very broad sense including two segregates now considered to have generic status, *Stizoides* Guérin-Méneville (corresponding to the *tridentatus* group) and *Bembecinus* A. Costa (including the nine other species groups recognized by Handlirsch). The monotypic *scolaeformis* group was erected by Arnold (1929) for the peculiar African species of that name. The *fasciatus* group is restricted to Africa and Eurasia; the *ruficornis* group also occurs in Africa and Eurasia but includes two North American species, and the *brevipennis* group occurs only in North America.

The *fasciatus* group is by far the largest and includes more than two thirds of the known species. Most of the remaining species belong to the *ruficornis* group, which takes its name from the type species of the genus. The principal difference between these groups is the presence of a well-defined, median, pubescent depression on the female scutellum in the *ruficornis* group but not the *fasciatus* group. Handlirsch (1892) also noted that the first intercubital vein is straight in the *ruficornis* group but somewhat curved with the convexity toward the apex of the wing in the *fasciatus* group. This venational difference, however, is slight at best, and its value as a distinguishing character has been questioned by Arnold (1929) and Lohrmann (1943), who noted that males cannot be reliably assigned to one group or the other in the absence of the associated females. The close similarity between the *fasciatus* and *ruficornis* groups has been noted by several authors, and Lohrmann (1943) pointed out that a weakly developed scutellar pit is present in several species generally assigned to the *fasciatus* group. He considered it likely that the *ruficornis* group is a polyphyletic derivative of the *fasciatus* group. These two groups taken together include more than 95% of the species currently recognized in *Stizus*, and it is to be hoped that a more solid basis for subdividing this large complex will eventually be discovered.

The other two species groups are clearly distinct but include very few species. Handlirsch (1892) recognized the *brevipennis* group on the basis of distinctive features of the male gaster. The relatively narrow sternum VIII with strongly downcurved prongs and the pointed apical projections on the digitus are apparently unique to this group. Handlirsch (1892) and Lohrmann (1943) considered the *brevipennis* group to be closely allied to the *fasciatus* group, but this conclusion is based on the fact that both groups retain certain primitive characters that provide little evidence for a close relationship. The principal similarities are: 1) female scutellar pit absent or at most only weakly developed in both groups, and 2) a well-defined pygidial plate bordered by carinae present in the *brevipennis* group and some members of the *fasciatus* group. As noted below, the *fasciatus* group shares several derived characters with the *ruficornis* group, and there would seem to be little doubt that these groups are more

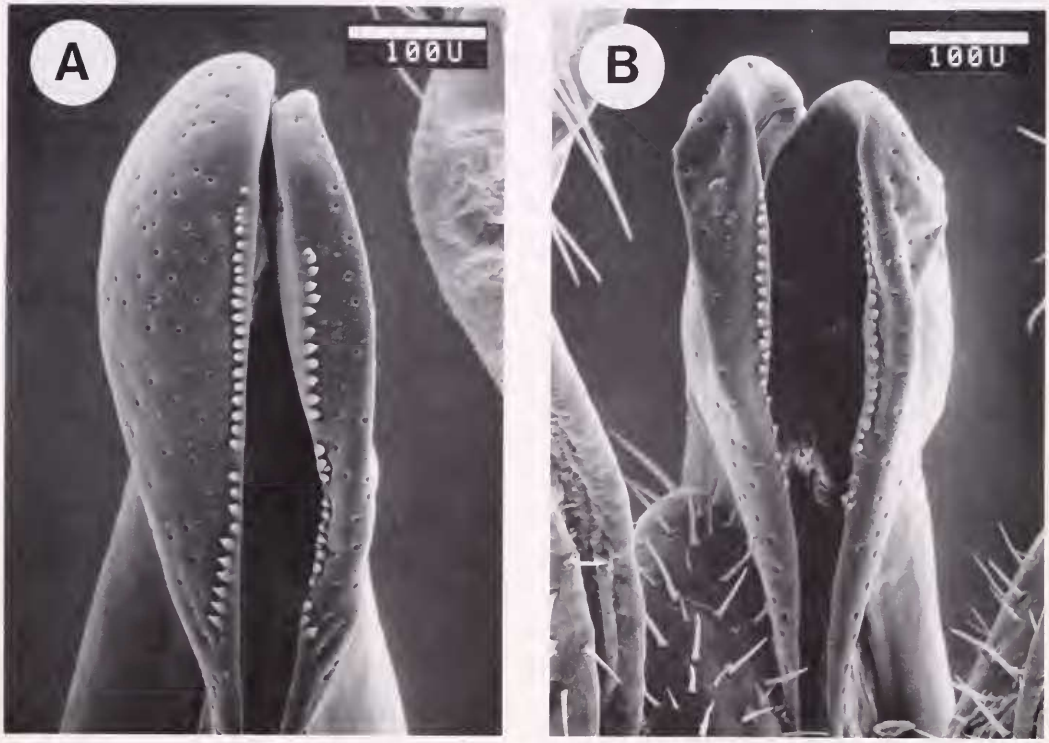

Figure 1. Apical enlargement of aedeagus in ventral view showing rows of minute teeth. A. *Stizus iridis* Dow. B. *Stizus occidentalis* Parker.

closely related to each other than either one is to the *brevipennis* group. The *scolaeformis* group includes only a single unusual species that could be viewed as representing a separate subgenus as noted by Arnold (1929). This species possesses a female scutellar pit as in the *ruficornis* group, a well-marked female pygidial plate as in the *brevipennis* group and some members of the *fasciatus* group, a carina to each side of the median carina on sternum I as in some *Stizoides*, and differs from all other species in having a much lengthened pronotum with an oblique anterior face instead of a shorter pronotum forming a discoid collar.

The North American *Stizus* represent two well-defined groups, the strictly Nearctic *brevipennis* group including *S. brevipennis*, *S. texanus*, and *S. aztecus* and the mostly Old World *ruficornis* group including *S. occidentalis* and *S. iridis*. Selected characters serving to distinguish the two groups are listed in Table 2. Several of the cited characters have not been noted by previous authors, and their distribution in the Old World species remains to be determined. It should be noted, however, that some of the characters cited for the North American species of the *ruficornis* group also occur in at least some members of the Old World *fasciatus* group. Flagellar tyloids, a broad and flat sternum VIII, and an evenly rounded digitus, for example, occur in both groups (see figs. in Mochi, 1939). Similarly, my dissections have revealed the presence of a carina on the inner surface of sternum VII in males of *S. imperialis*, *S. marthae* (=*cheops*), and *S. vespiformis* of the *fasciatus* group as well as *S. combustus* (=*fuliginosus*), and *S. ruficornis* of the *rufi-*

TABLE 2. SPECIES GROUP CHARACTERS IN NORTH AMERICAN *Stizus*.

brevipennis group	*ruficornis* group (North American species)
1. Head in facial view with vertex convex, lateral ocelli not projecting above vertex.	1. Head in facial view with vertex nearly straight, lateral ocelli projecting above vertex.
2. Male antenna without tyloids.	2. Male antenna with tyloids on some flagellomeres.
3. Female scutellum with median pubescent depression poorly developed or absent.	3. Female scutellum with well-defined median pubescent depression.
4. Lower posterior face of propodeum with a pair of carinae extending upward from the submarginal sulcus.	4. Lower posterior face of propodeum without a pair of carinae.
5. Female tergum VI with a well-defined pygidial plate bordered by carinae.	5. Female tergum VI without a pygidial plate.
6. Male sternum VII without a carina on inner surface.	6. Male sternum VII with a longitudinal carina on inner surface.
7. Male sternum VIII narrow with lateral prongs strongly downcurved.	7. Male sternum VIII broad with lateral prongs nearly straight.
8. Male genitalia with digitus produced into pointed projections distally.	8. Male genitalia with digitus evenly rounded distally.
9. Apical portion of aedeagus without minute teeth.	9. Apical portion of genitalia with minute teeth on ventral margin as shown in Figure 1.
10. Appressed pubescence generally distributed over body.	10. Appressed pubescence restricted to legs, larger veins, and sclerites base of wings.

cornis group. These shared characters further emphasize the similarity of the *fasciatus* and *ruficornis* groups and reveal the distinctive nature of the *brevipennis* group. Indeed, there would seem to be sufficient grounds for treating the *brevipennis* group as a separate subgenus for which the name *Megastizus* Patton is available, but I hesitate to do so without examining more Old World material.

In any event, the North American *Stizus* represent two distinct lineages that may well date from early in the diversification of the genus. The *ruficornis* group would seem to be more advanced as evidenced by such apparently derived characters as flagellar tyloids, well-marked female scutellar pit, absence of a pygidial plate, longitudinal carina on male sternum VII, and minute teeth on the aedeagus. Most of these are also present in the *fasciatus* group, and it may well be that the *brevipennis* group represents the most generalized living *Stizus*, although the Old World fauna must be examined more thoroughly before this can be said with confidence. It is very likely that the North American species of the *ruficornis* group represent a relatively recent invasion from Eurasia, presumably by way of the Beringian connection. The *brevipennis* group, on the other hand, has probably been in North America for a much longer time and may date from before the separation of North America and Europe during the Eocene. Unfortunately, no fossil *Stizus* have yet been discovered.

KEY TO THE NORTH AMERICAN SPECIES OF *STIZUS*

1. Males; antenna with 11 flagellomeres; gaster with 7 visible terga 2
   Females; antenna with 10 flagellomeres; gaster with 6 visible terga 6
2. Flagellomeres without tyloids; sternum VII without carina on inner surface; sternum VIII (Figs. 2, 3 and 4) relatively narrow with lateral prongs strongly downcurved. (*brevipennis* group) 3
   Flagellomeres VII and VIII with linear carinate tyloids; sternum VII with a median

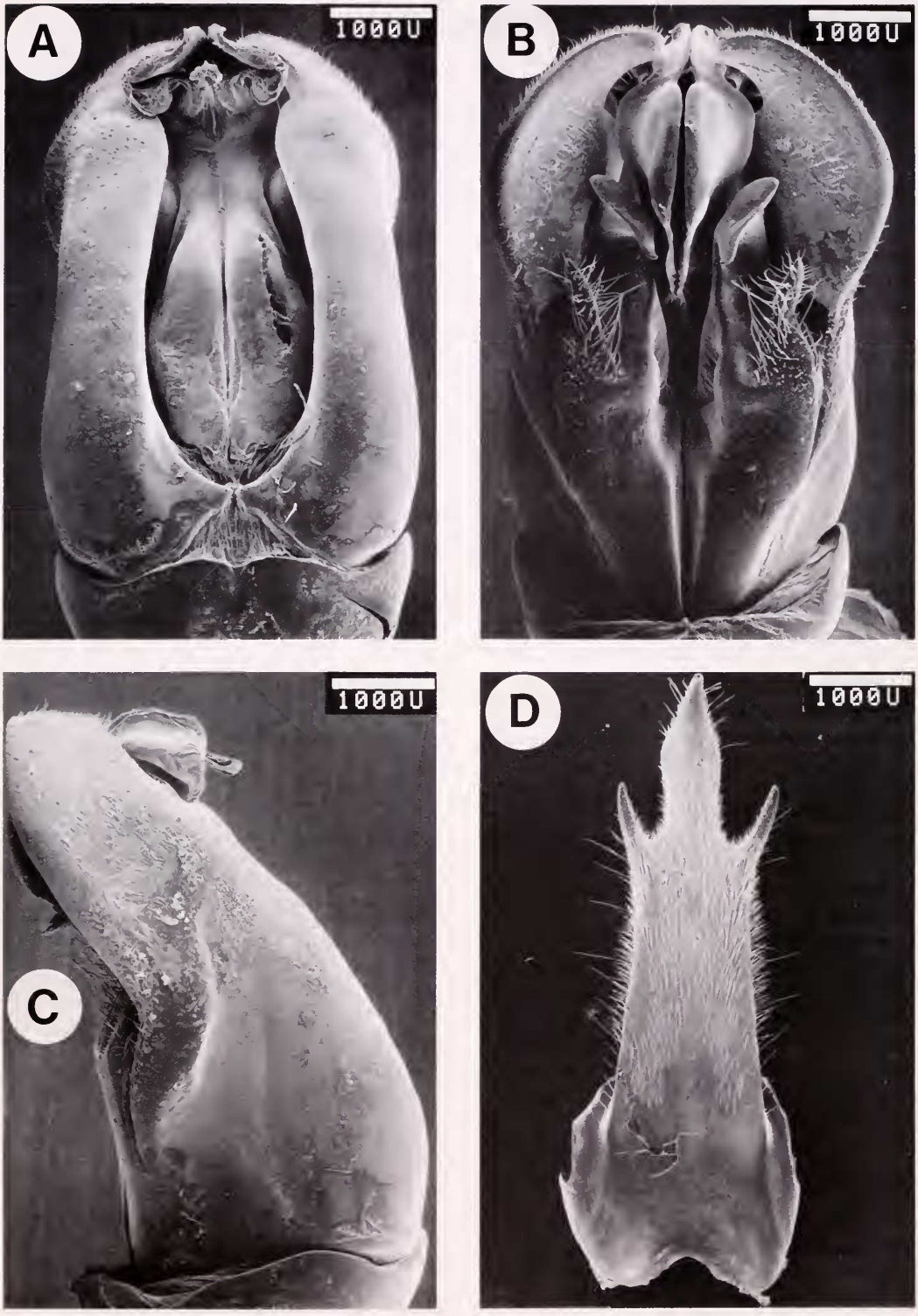

Figure 2. *Stizus brevipennis* Walsh. Male genitalia in A. dorsal, B. ventral, and C. lateral views; D. male sternum VIII, ventral view.

longitudinal carina on inner surface; sternum VIII (Figs. 5 and 6) relatively broad with lateral prongs nearly straight. (*ruficornis* group) 5

3. Anterior margin of clypeus tri-emarginate, the median emargination very shallow; tergum VII broadly rounded posteriorly, without a median emargination; sternum VI deeply emarginate apically; sternum VII with heavily sclerotized portion narrowly triangular, tapering to a point apically; sternum VIII with median prong subparallel basally (Fig. 2) ..... *brevipennis* Walsh

Anterior margin of clypeus evenly rounded; tergum VII abruptly narrowed and flattened posteriorly with a small median emargination; sternum VI shallowly emarginate apically; sternum VII with heavily sclerotized portion truncate and shallowly emarginate apically; sternum VIII with median prong broadly triangular, not subparallel basally 5

4. Genitalia (Fig. 3) relatively slender with longitudinal axis almost perpendicular to basal margin in lateral view; apical enlargement of aedeagus narrower than distance from tip to tip of the two pointed projections at the apex of each digitus ..... *texanus* Cresson

Genitalia (Fig. 4) more robust with longitudinal axis oblique to basal margin in lateral view; apical enlargement of aedeagus wider than distance from tip to tip of the two pointed projections at the apex of each digitus ..... *aztecus* new species

5. Distinct tyloids present on flagellomeres V to IX; posterior margin of clypeus nearly straight; sides of first tergum slightly convex in dorsal view; mesopleura, metapleura, and propodeum mostly or entirely black ..... *occidentalis* Parker

Distinct tyloids present on flagellomeres IV to XI; posterior margin of clypeus slightly but distinctly emarginate; sides of first tergum concave in dorsal view; mesopleura (except ventrally), metapleura, and propodeum almost entirely yellow ..... *iridis* Dow

6. Head in facial view with vertex convex, lateral ocelli not projecting above vertex; tergum VI with a well-defined pygidial plate bordered by carinae; appressed pubescence widely distributed (*brevipennis* group) 7

Head in facial view with vertex nearly straight, lateral ocelli projecting above vertex; tergum VI without a well-defined pygidial plate; appressed pubescence restricted to legs, larger veins, and axillary sclerites (*ruficornis* group) 9

7. Anterior margin of clypeus with a broad, medially angulate emargination; lower margins of tergum VI strongly sinuous in lateral view ..... *brevipennis* Walsh

Anterior margin of clypeus with a shallow, rounded emargination; lower margins of tergum VI with basal three quarters nearly straight in lateral view 8

8. Scutellum and metanotum marked with yellow, often extensively so ..... *texanus* Cresson

Scutellum and metanotum entirely ferruginous without yellow maculations ..... *aztecus* new species

9. Posterior margin of clypeus nearly straight; sides of tergum I slightly convex in dorsal view; mesopleura, metapleura, and propodeum mostly or entirely black ..... *occidentalis* Parker

Posterior margin of clypeus shallowly emarginate; sides of tergum I concave in dorsal view; mesopleura (except ventrally), metapleura, and propodeum almost entirely yellow ..... *iridis* Dow

Stizus brevipennis Walsh

1869 *Stizus brevipennis* Walsh, Amer. Entomologist **1**(8): 162. ♂.

1875 *Larra brendeli* Taschenberg, Zeitschr. f. d. Ges. Naturwiss. **45:** 361. ♂.

1879 *Megastizus brevipennis* (Walsh). Patton, Bull. U.S. Geol. Terr. **5:** 345. ♂♀.

1880 *Megastizus brevipennis* (Walsh). Taschenberg, Zeitschr. f. d. Ges. Naturwiss. **53:** 779.

1887 *Megastizus brevipennis* (Walsh). Cresson, Synopsis, Trans. Amer. Ent. Soc., Supp., p. 278 (in part).

1892 *Stizus brevipennis* Walsh. Handlirsch, Sitzber. k. Akad. Wiss. Wien, Math.-nat. Cl., Abt. 1, **101**(1): 174, pl. 1, fig. 13, pl. 2, fig. 28, pl. 3, fig. 15. ♂♀.

1895 *Stizus brevipennis* Walsh. Fox, Proc. Acad. Nat. Sci. Philadelphia 1895: 266–268. ♂♀.

1908 *Stizus* (*Megastizus*) *brevipennis* Walsh. Johnson and Rohwer, Ent. News **19**(8): 374.

1917 *Stizus brevipennis* Walsh. Mickel, Univ. Nebraska Studies **17**(4): 117.

1941 *Megastizus brevipennis* (Walsh). Snodgrass, Smiths. Misc. Coll. **99**(14): pl. 19, figs. A–G. Male genitalia.

1942 *Stizus brevipennis* Walsh. Dow, Psyche **48:** 176–178, 180–181 (key), fig. 6.

1965 *Stizus brevipennis* Walsh. Chandler, Proc. Indiana Acad. Sci. **75:** 142.

1966 *Stizus brevipennis* Walsh. Evans, Comp. Ethol. Evol. Sand Wasps, p. 117, figs. 63–68.

1976 *Stizus brevipennis* Walsh. Bohart and Menke, Sphecid Wasps of the World, pp. 524–526, fig. 180K.

Male: Length 26 to 31 mm.

Structure. Head in facial view with lateral ocelli not projecting above the rounded vertex. Clypeus with apical margin tri-

emarginate, the median emargination very shallow; supraclypeal area relatively long, width/length about 2.34 (width measured between compound eyes at lower margin of antennal sockets, length measured along midline from posterior margin of clypeus to lower margin of antennal sockets); median frontal depression surrounding midocellus. Flagellum without tyloids; apical flagellomere distinctly emarginate within. Mandible with a prominent subapical tooth set off by a distinct notch, closer to apex than in *S. texanus*; ridge extending basad along inner surface from subapical tooth distinctly convex in anterior view of spread mandibles.

Mesosoma in dorsal view similar to *S. texanus*, not as robust as in *S. aztecus*; width across pronotal lobes 5 to 7 mm, typically about 6.5 mm; scutum with notauli present as indistinct, faint impressions; admedian lines present as simple impressed lines; parapsidal lines present, not carinate and not extending to the posterior margin; scutal laminae with posterior margin behind oblique scutal carina produced into a distinct lobe; lower posterior face of propodeum with a pair of carinae extending upward from submarginal sulcus. Length of forewing 15.5 to 19.5 mm, typically about 17.5 mm.

Gaster robust; tergum VII narrowed posteriorly, apex evenly rounded; spiracular lobes broad, about twice as long as wide, broadly triangular at apex. Sternum VI deeply emarginate apically; sternum VII with heavily sclerotized portion narrowly triangular, tapering to a point, without carina on inner surface; sternum VIII as shown in Figure 2, narrow, median prong arched downward with sides subparallel basally. Genitalia as shown in Figure 2, cupsides hairy.

Vestiture. Short appressed pubescence generally distributed over body; suberect pale hairs also present, densest and most conspicuous on upper clypeus, lateral margins of frons, vertex, occiput, mesosoma generally (longer on propodeum and lower lateral and ventral portions of mesopleura), and anterior face of tergum I, sparse on genae, pronotum, and sterna, virtually absent from terga. Wings densely clothed with erect setae, gradually replaced with short appressed pubescence basally and toward anterior margin; larger veins with short appressed pubescence.

Color. Black marked with pale yellow and ferruginous.

Head mostly black, sometimes partly replaced with ferruginous especially on the vertex and occiput in specimens from more western localities; labrum and clypeus pale yellow bordered apically with a narrow band of ferruginous; supra-clypeal area and inner orbits to level of anterior ocellus pale yellow except for a black line along posterior margin of clypeus, dark extensions upward from tentorial pits sometimes present; narrow postorbital stripe pale yellow. Palpi and galeae pale yellowish ferruginous; mandible dark apically and basally, shading to yellow on outer surface. Scape yellow below and black shading to ferruginous above; pedicel and basal half of flagellomere I ferruginous, darker above and paler or even yellowish below; flagellomere II sometimes ferruginous basally on lower surface; apical flagellomere orange apically and on ventral surface; penultimate flagellomere sometimes orange except basally; the remainder of flagellum fuscous, sometimes shading to a hint of ferruginous ventrally at apex of some flagellomeres, sometimes more extensively ferruginous in western specimens.

Mesosoma mostly black, sometimes more or less extensively replaced with ferruginous in western specimens especially on pronotum, mesopleura above, scutellum, and propodeum; pronotum with pale yellow dorsal margin which is often wider to each side and sometimes shades to ferruginous anteriorly; distal half of pronotal lobes pale yellow; scutum laterally, tegulae, and base of wings ferruginous, sometimes tending to yellow; scutal disk usually black but sometimes partly replaced with ferruginous in western specimens;

scutellum with or without lateral pale yellow spots; metanotum with a yellow band. Wings subhyaline, lightly suffused with amber which tends to be darker along the second recurrent vein; veins of both wings ferruginous except for the costal vein of the forewing and the veins surrounding the marginal cell which tend to be darker, almost brown. Legs mostly yellow, more or less suffused with ferruginous; coxae, trochanters, and femora basally black, sometimes largely replaced with ferruginous in western specimens; femora ferruginous with ventral surface more or less yellow.

Gaster mostly black, sometimes partly replaced with ferruginous in western specimens, especially on terga I and II; first four terga with pale yellow lateral spots, those on terga I and II widely separated medially and rounded, subquadrate, or slightly oblong, those on terga III and IV only narrowly separated medially or continuous, much elongate. Sterna mostly black, sometimes partly replaced with ferruginous especially in western specimens; sternum II sometimes with a pair of small, widely separated, pale yellow spots; sterna III and IV with a pair of subtriangular, pale yellow, lateral spots of variable size; sternum VIII straw-colored. Genitalia ferruginous.

Female: Similar to male; length 22 to 33 mm.

Structure. As in male, aside from the usual sexual differences and the following exceptions: clypeus with a shallowly V-shaped emargination apically; apical flagellomere curved but not distinctly emarginate within; parapsidal lines sometimes extending to posterior margin of scutum. Width across pronotal lobes 6 to 7 mm. Forewing length 17 to 20 mm. Apical tergum with a well defined pygidial plate bordered by carinae; lower margin of tergum VI strongly sinuous in lateral view (see Dow, 1941: fig. 6).

Vestiture. As in male.

Color. Similar to male, exhibiting a similar range of variation.

Type. Walsh (1869) gave no indication of the location of the type specimen, and we are left to assume that it remained in his personal collection. Walsh died shortly after describing *Stizus brevipennis* and there is a short notice in the *American Entomologist* (1870, **2**(9): 275) to the effect that his collection was posthumously sold to the State of Illinois and that it was "temporarily deposited" in the museum of the Chicago Academy of Sciences. A historical sketch of the Academy published in 1877 cites the Walsh Collection of Insects as one of a number of collections destroyed by the Chicago fire of October 9, 1871. Dr. Henry S. Dybas (personal communication) has not been able to locate any *Stizus* in the holdings of the Field Museum of Natural History, the probable location of any existing remnants of the original Chicago Academy collections. It can be safely assumed that the type of *Stizus brevipennis* no longer exists.

Type Locality: "One taken in summer on wild parsnip flowers near Rock Island, Ill." (Walsh, 1869: 162).

Distribution: *Stizus brevipennis* is widely distributed in the eastern United States. In addition to the records cited below, this species is known to occur in North Carolina (Brimley, 1938) and Indiana (Chandler, 1954). Collection dates range from June 12 to September 3. Published floral records include only Walsh's (1869) report that the holotype was taken at flowers of "wild parsnip" and the report of Evans (1966: 125) that he has taken *S. brevipennis* at flowers of *Melilotus* and *Euphorbia* in Kansas. Records taken from specimen labels add only the genera *Ampelopsis* and *Cicuta*.

I have examined the following specimens, 42 males and 30 females:

COLORADO: *Jefferson Co.*: Golden, Chimney Gulch, ♀, (Oslar, UCD).

FLORIDA: *Alachua Co.*: Gainesville, ♂, VII-7-1918 (P. W. Fattig, USNM); ♂, VII-16-1918 (P. W. Fattig, USNM); ♂, VII-18-1918 (P. W. Fattig, USNM); 2 ♂, VII-22-1918 (P. W. Fattig, AMNH, JWS). *Co. unknown*: Cape Barrancas, ♀, (C. W. Willard, MCZ).

ILLINOIS: 2 ♂ (AMNH).

IOWA: *Henry Co.*: Mt. Pleasant, ♀, VII-?-1920 (USNM). *Woodbury Co.*: Sioux City, ♀, IX-3-1921 (A. W. Lindsay, MCZ).

KANSAS: *Butler Co.*: 1286 ft, ♀, ?-?-1916 (R. H. Beamer, USNM). *Decatur Co.*: ♂, ♀, VII-6-1925 (R. H. Beamer, USNM); ♂, VII-6-1925 (H. J. Grady, USNM). *Dickinson Co.*: 4 ♂, 2 ♀, and a copulating pair, VIII-?-1901 (J. C. Bridwell, USNM). *Douglas Co.*: Baldwin, ♂, VII-?-? (J. C. Bridwell, USNM). 900 ft, ♂ (F. H. Snow, USNM). *Greenwood Co.*: ♂, VIII-1-1923 (Beamer and Lawson, USNM). *Jewell Co.*: Montrose, ♂, VIII-11-1961 (F. P. Rindge, AMNH). *Osborne Co.*: 1557 ft, ♂, ♀, VIII-3-1912 (F. X. Williams, USNM). *Pottawatomie Co.*: Blackjack Creek, ♂, VII-2-1953 (Evans, Lin, and Yoshimoto, MCZ). *Riley Co.*: ♂, VII-20-1953 (Evans, Lin, and Yoshimoto, MCZ). Deep Creek, ♂ (USNM). Popenoe, ♀, VII-9-? (USNM); ♂, VII-3-? (USNM). *Stafford Co.*: Salt Flats Area, ♂, VIII-20-1953 (Evans, Lin, and Yoshimoto, MCZ). *Sumner Co.*: 1189 ft, ♀, ?-?-1916 (R. H. Beamer, USNM). Wellington, ♀ (H. R. Watts, USNM).

LOUISIANA: *St. Tammany Parish*: Covington, ♀, VI-12-1951 (Price, Beamers, and Wood, USNM).

MARYLAND: *Charles Co.*: Indian Head, ♂, ♀, VIII-23-1902 (Bridwell, USNM).

MISSISSIPPI: *Forrest Co.*: Hattiesburg, ♀, VII-29-1944 (C. D. Michener, AMNH).

MISSOURI: *St. Louis Co.*: St. Louis, ♀, VII-?-1911 (Coll. of P. Rau, USNM).

NEBRASKA: *Furnas Co.*: 2 ♂, 3 ♀ (PANS). Cambridge, ♀, VII-26-1921 (A.P.M., MCZ); ♂, VIII-2-1921 (A.P.M., MCZ); ♂, VIII-22-1923 (A.P.M., MCZ).

OKLAHOMA: *Carter Co.*: Ardmore, ♂, VII-11-? (C. R. Jones, USNM); ♀, VIII-18-1905 (C. R. Jones, USNM). *Marshall Co.*: Lake Texoma, 2 mi E of Willis, ♂, 4 ♀, VII-?-1965 (R. M. Bohart, UCD); ♀, VII-?-1965 (R. M. Bohart, JWS).

SOUTH DAKOTA: *Bon Homme Co.*: Springfield, ♂, VIII-27-1926 (H. C. Severin, MCZ).

TEXAS: *Bexar Co.*: ♂, VII-11-1931 (H. B. Parks, TA&M); ♂, VII-24-1932 (H. B. Parks, TA&M). San Antonio, ♂ (H. B. Parks, USNM). *Brazos Co.*: College Station, ♂, VI-12-1932 (S. W. Bromley, USNM); ♂, VI-25-1937, on flowers of *Ampelopsis arborea* (Strandtmann, MCZ). *Gonzales Co.*: Palmetto State Park, ♂, VI-20-1956 (H. E. Evans and E. G. Matthews, MCZ). *Lee Co.*: Giddings, ♀, VII-6-1948 (H. E. Evans, MCZ). *Titus Co.*: Mt. Pleasant, ♂, VI-13-1948, on flowers of *Cicuta maculata* L. (H. E. Evans, MCZ). *Washington Co.*: Washington State Park, ♀, VI-17-1956 (H. E. Evans and E. G. Matthews, MCZ). *Co. unknown*: ♂ (PANS); ♂, ♀ (Belfrage, USNM).

WISCONSIN: *Milwaukee Co.*: Milwaukee, ♂, VIII-17-1917 (S. Graenicher, MCZ).

Remarks: Stizus brevipennis is a very distinctive species easily recognized in either sex by the characters cited in the key. It is the only *Stizus* likely to be encountered east of the Mississippi River. Williams (1914) observed a female of this species hunting a short-winged adult female of *Conocephalus* in Kansas.

Stizus texanus Cresson

1872 *Stizus texanus* Cresson, Trans. Amer. Ent. Soc. **4:** 222. ♂ ♀.

1879 *Megastizus texanus* (Cresson). Patton, Bull. U.S. Geol. Surv. Terr. **5:** 345. ♂ ♀.

1878 *Megastizus brevipennis* (Walsh). Cresson, Synopsis, Trans. Amer. Ent. Soc., Supp., p. 278 (in part).

1892 *Stizus texanus* Cresson. Handlirsch, Sitz. k. Akad. Wiss. Wien, Math.-nat. Cl., Abt. 1, **101**(1): 176, pl. 1, figs. 2, 6, 14, 15; pl. 2, fig. 29; pl. 3, fig. 16.

1895 *Stizus texanus* Cresson. Fox, Proc. Acad. Nat. Sci., Philadelphia 1895: 267–268.

1897 *Stizus texanus* Cresson. Kohl, Ann. k. k. Naturhist. Hofmus., Wien 11: pl. VIII, fig. 126; pl. IX, fig. 150; pl. X, fig. 168.

1942 *Stizus texanus* Cresson. Dow, Psyche **48:** 178–179, 180 (key).

Male: Length 24 to 33 mm.

Structure. Head in facial view with lateral ocelli not projecting above the rounded vertex; clypeus with apical margin nearly straight along median half; supraclypeal area intermediate, width/length about 2.46 (measured as in *S. brevipennis*); median frontal depression surrounding median ocellus. Flagellum without tyloids, apical flagellomere distinctly emarginate within, apex more rounded than in *S. aztecus*. Mandible with a prominent subapical tooth set off by a distinct notch, further from apex than in *S. brevipennis*, ridge extending basad along inner surface from subapical tooth nearly straight in anterior view of spread mandibles.

Mesosoma robust; width across pronotal lobes 5 to 7.5 mm, typically about 6.5 mm; scutum without evident notauli; admedian lines carinate anteriorly, impressed lines posteriorly; parapsidal lines faint, not reaching posterior margin of scutum; scutal laminae behind oblique scutal carina produced into a distinct lobe. Length of forewing 19 to 22.5 mm.

Gaster robust but more slender than in *S. aztecus*; tergum VII abruptly narrowed into a flattened truncate projection with a small but distinct median emargination. Sternum VI shallowly emarginate apically; sternum VII with heavily sclerotized portion triangular, shallowly emarginate apically; sternum VIII as shown in Figure 3, mostly hidden by sternum VII, median prong broadly triangular in ventral view, not subparallel basally, prongs distinctly curved downward but not so strongly as in *S. aztecus*. Genitalia as shown in Figure 3, more slender in both ventral and lateral views than in *S. brevipennis* or *S. aztecus*; apical enlargement of aedeagus narrower than distance from tip to tip of pointed projections at apex of each digitus; cuspides with relatively short setae, without long hairs.

Vestiture. As in *S. brevipennis.*

Color. Ferruginous and black, extensively marked with yellow.

Head mostly ferruginous, sometimes partly replaced with black especially in specimens from more eastern localities, with yellow markings. Mandibles ferruginous shading to black apically; labial and maxillary palpi yellow suffused with ferruginous. Labrum and clypeus yellow with narrow ferruginous borders apically; supraclypeal area yellow with a ferruginous or black line along posterior margin of clypeus; tentorial pits and lines extending from them to antennal sockets ferruginous, sometimes partly replaced with black, lines to antennal sockets sometimes indistinct. Broad inner orbits to level of midocellus yellow; supra-antennal area between yellow of inner orbits all ferruginous, or all black, or ferruginous with a pair of black spots above antennae, and often with a black spot surrounding the midocellus; area above midocellus and vertex either all ferruginous or partly and sometimes extensively replaced with black; inner orbits above midocellus ferruginous even in darker individuals. Postorbital yellow stripe often present, sometimes restricted to top half of compound eye, and sometimes absent; occiput often entirely ferruginous, sometimes partly replaced with black especially within occipital carina, black sometimes more extensive, occasionally continuous with the vertex which is also black in such melanic individuals. Scape yellow below, ferruginous above; pedicel ferruginous; flagellomere I ferruginous, paler below, and sometimes with a fuscous spot above near apex; flagellomere II often mostly ferruginous; flagellomere XI ferruginous apically and ventrally; remainder of flagellum ranging from ferruginous below and fuscous above to entirely fuscous in darker individuals.

Mesosoma ferruginous, sometimes more or less extensively replaced with black, marked with yellow. Pronotum mostly ferruginous, sometimes partly replaced with black; dorsal margin with a band of yellow which is often wider to each side; pronotal lobes yellow; small yellow spot sometimes present anterior to each pronotal lobe. Scutum with disk ranging from ferruginous, to partly black, to all black in the darkest individuals; broad lateral margins always ferruginous or ferruginous tinged with yellow. Scutellum ferruginous, sometimes with anterior margin black, often with a pair of oblong lateral spots which are sometimes connected medially, occasionally mostly yellow. Metanotum ferruginous, sometimes black anteriorly, with a yellow band which is sometimes interrupted medially. Propodeum ranging from ferruginous, to partly black, to entirely black; yellow spots sometimes present on lateral angles above and within dorsal enclosure laterally. Mesopleura and metapleura ranging from ferruginous to more or less extensively black; very small yellow spot sometimes present behind each pronotal lobe in paler specimens. Coxae entirely ferruginous or black basally; trochanters and femora ferruginous, partly fuscous in darker individuals; tibiae and tarsi ferruginous, sometimes tinged with yellow; claws dark distally. Tegulae and post-tegulae ferruginous, sometimes partly yellow. Veins of

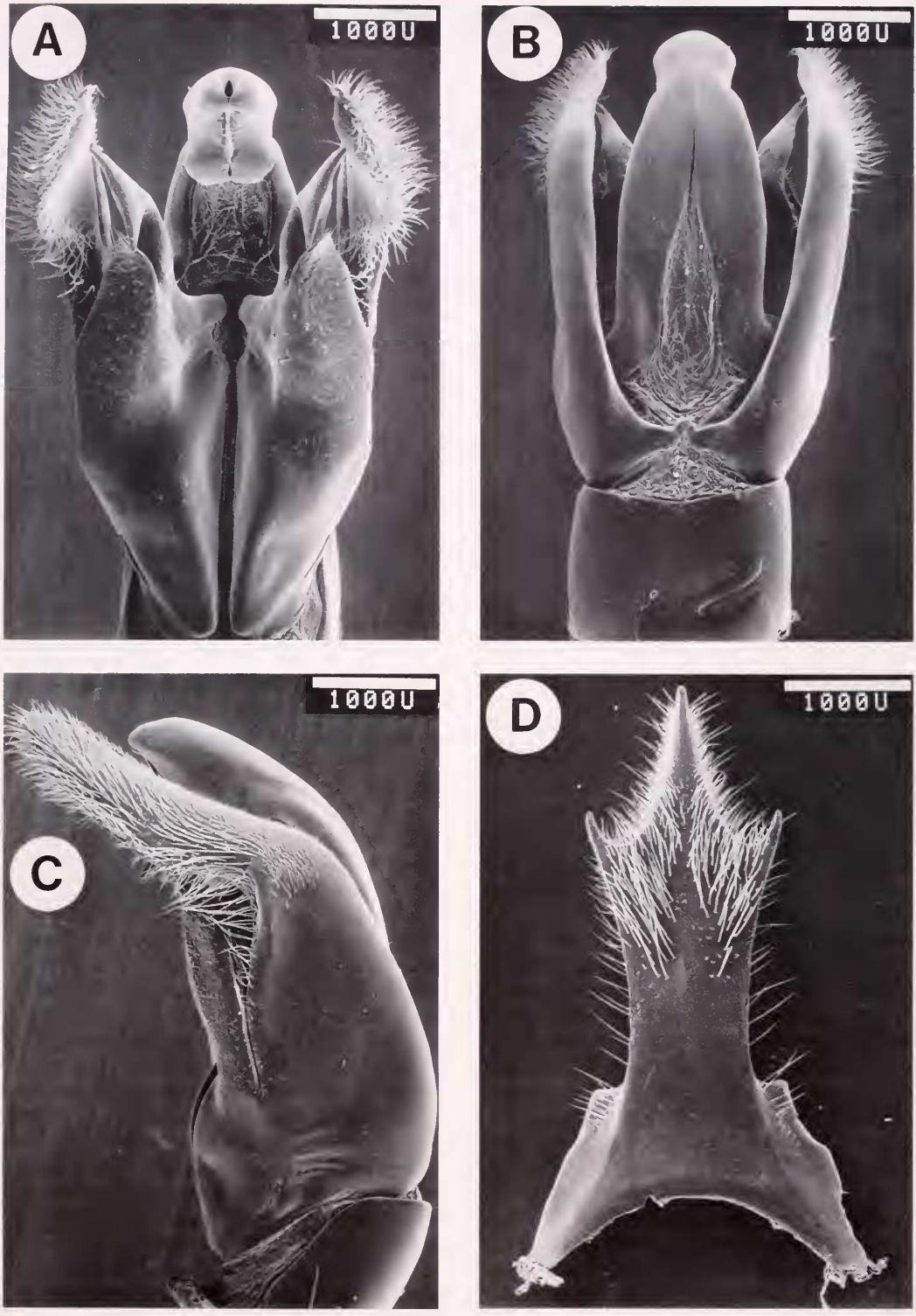

Figure 3. *Stizus texanus* Cresson. Male genitalia in A. dorsal, B. ventral, and C. lateral views; D. male sternum VIII, ventral view.

both wings ferruginous, those surrounding marginal and submarginal cells and both recurrent veins darker, almost brown; membranes of both wings subhyaline, tinged with dark amber, slightly infumate in marginal cell and along transverse cubital veins.

Gaster ranging from ferruginous to extensively dark brown or black, marked with yellow. Terga I to IV with large lateral yellow spots, these widely separated and rounded or subquadrate on terga I and progressively closer together and more elongate on more distal terga, sometimes connected medially on terga III and IV; terga V and VI with or without yellow markings, when present these range from small, widely separated spots to a continuous band of yellow; when the spots on any tergum are joined medially to form a continuous yellow band, the anterior margin of the band deeply and more or less triangularly emarginate medially, and posterior margin nearly straight or only shallowly emarginate medially; tergum VII sometimes tinged with yellow in paler individuals. Sternum II with or without lateral yellow spots of variable size; sterna III and IV always with lateral yellow spots of variable size, sometimes connected medially; sternum V sometimes with small lateral yellow spots.

Female. Similar to male; length 24 to 30 mm.

Structure. Much as in male; frons somewhat wider; clypeus somewhat shorter, more transverse, apical margin nearly straight or with a shallowly rounded emargination; apical flagellomere more evenly curved, apex evenly rounded; scutellum with or without a very shallow median depression. Width across pronotal lobes 6 to 7.5 mm. Forewing length 21 to 23 mm. Apical tergum with a well-defined pygidial plate bordered by carinae; lower margin of tergum VI with basal three fourths nearly straight in lateral view.

Vestiture. As in *S. brevipennis*.

Color. Similar to male, exhibiting a similar range of variation; scutellum apparently always marked with yellow; pygidial plate fuscuous.

Types: Male holotype No. 2054.1 in the collection of the Philadelphia Academy of Natural Sciences. Two additional specimens in the Museum of Comparative Zoology collected by Boll in Dallas, Texas bear type labels No. 512 (1) and No. 512 (2) and may be part of the original series of four specimens studied by Cresson.

Type Locality: Dallas, Texas.

Distribution: *Stizus texanus* is known from southeastern Arizona, New Mexico, Texas, Oklahoma, southwestern Arkansas, and Chihuahua, Mexico. Evans (1966: 125) reported taking this species on flowers of *Baccharis* in Arizona, and data from labels add the genera *Helianthus* and *Asclepias* as nectar sources. Collection dates range from May to September.

I have examined the following specimens, 33 males and 34 females:

ARIZONA: *Cochise Co.*: Douglas, ♀, VIII-12-1936 (W. W. Jones, MCZ): 25 mi NE, ♂, IX-1-1965, on flowers of *Helianthus annuus* L. (J. H. Davidson and M. A. Cazier, UCD). Willcox, 6 mi SW, ♀, VIII-9-1948, on flowers of *Asclepias* (H. E. Evans, MCZ). *Pima Co.*: Tucson, ♀ (G. v. Krockow, AMNH).

ARKANSAS: *Little River Co.*: ♀, VII-2-1944 (UCD).

NEW MEXICO: *Otero Co.*: White Sands National Monument, 2 ♂, ♀ (C. R. Kovacic, D. R. Miller, UCD). *Socorro Co.*: Bernardo, ♂, VII-24-1970 (B. Apperson, BBSL).

OKLAHOMA: *Murray Co.* (?): Arbuckle Mts., 2 ♂, (R. H. Beamer, USNM).

TEXAS: *Bexar Co.*: 7 ♀, V-21-1931, VI-23-1931, VI-14, 22, 23, 26-1932 (H. B. Parks, TA&M); ♂, VI-24-1932 (H. B. Parks, TA&M). San Antonio, 3 ♂, V-27-1927 (USNM); ♂, VI-29-1956 (H. E. Evans, E. G. Matthews, MCZ). *Brewster Co.*: Alpine, ♂, VI-4-1927 (USNM); 32 mi S, ♂, VI-6-1961 (R. Gamez, MCZ). Big Bend National Park, Chisos Mts., 2 ♂, ♀ (J. Bequaert, MCZ). *Crane Co.*: Junction US 80 and farm-road 1053, 3 mi S, ♂, VI-10-1961, on flowers of *Asclepias subverticillata* (J. E. Gillaspy, MCZ). *Dallas Co.*: 9 ♂, 8 ♀ (Boll, MCZ); holotype (Boll, PANS). *Fannin Co.*: Bonham, ♀, VII-2-1936 (TA&M). *Kaufman Co.*: ♀, VII-10-1935 (J. H. Robinson, MCZ). *Lasalle Co.*: Cotulla, ♂, 4 ♀, VI-21-1906 (H. Caley, MCZ). *Webb Co.*: Laredo, 2 ♀, VI-16-1924 (USNM). *Co. unknown*: ♂, ♀ (MCZ).

CHIHUAHUA, MEXICO: Cyn de Bachimba, 27 mi S Chihuahua, ♀, IX-7-1950 (R. F. Smith, AMNH). Hidalgo del Parral, 2 ♀, VII-22-1967 (R. C. Gardner,

C. R. Kovacic, K. Lorenzen, UCD, JWS); 4 ♂, VIII-10-1967 (R. C. Gardner, C. R. Kovacic, UCD, JWS); 9 mi S, ♀, VIII-8-1967 (R. C. Gardner, C. R. Kovacic, K. Lorenzen, UCD). Meoqui, 6 mi NE, 2 ♂, IX-2-1950 (R. F. Smith, AMNH).

Remarks: Stizus texanus occurs in two fairly distinct color phases. Specimens from the eastern portion of the range (southwestern Arkansas, eastern Oklahoma, and eastern Texas) are very dark with the typically ferruginous areas tending to a dark brown, while those from more western localities (most of Texas, New Mexico, Arizona, and Chihuahua) are mostly ferruginous with very little, if any, dark brown and have the yellow maculation more extensively developed. Two males from the Arbuckle Mountains of Oklahoma are interesting in this regard since one is very dark while the other closely approaches the more xanthic coloration exhibited by individuals from the western and more xeric portions of the range. This example of the two color phases occurring in close proximity, together with the fact that various intermediate forms are sometimes encountered, leaves little reason to grant subspecific status to the two color phases.

Stizus aztecus new species

Holotype male: Length 30 mm.

Structure. Very similar to *S. texanus*, differing most concretely in the genitalia. *Head* in facial view with lateral ocelli not projecting above rounded vertex. Clypeus with apical margin evenly rounded, median half not nearly straight; supraclypeal area relatively broad, width/length about 2.76 (measured as in *S. brevipennis*); median frontal depression surrounding midocellus. Flagellum without tyloids; apical flagellomere distinctly emarginate within, apex more angulate than in *S. texanus*.

Mesosoma robust; width across pronotal lobes 7 mm. Scutum without evident notauli; admedian lines carinate throughout; parapsidal lines faint, not reaching posterior margin of scutum; posterior margin of scutal lamina produced into a distinct lobe behind oblique scutal carina; propodeum with a pair of carinae on lower posterior surface extending upward from submarginal sulcus. Forewing length 22 mm.

Gaster robust, more inflated than in *S. texanus*. Tergum VII and sternum VI as in *S. texanus*; sternum VII somewhat broader and more distinctly emarginate apically than in *S. texanus*; sternum VIII as shown in Figure 4, more robust than in *S. texanus*. Genitalia as shown in Figure 4, more robust than in *S. texanus*, longitudinal axis clearly oblique to basal margin; apical enlargement of aedeagus wider than distance from tip to tip of the two pointed projections at apex of each digitus; cuspides with short setae, without long hairs.

Vestiture. As in *S. brevipennis*.

Color. Black and ferruginous marked with whitish yellow. *Head* mostly ferruginous; clypeus whitish yellow bordered apically with a narrow band of ferruginous; supraclypeal area whitish yellow; line along posterior margin of clypeus ferruginous; tentorial pits and lines extending from them to antennal sockets black bordered by ferruginous; inner orbits to near level of midocellus whitish yellow; supra-antennal area ferruginous with a black spot adjacent to each antennal socket; frons above midocellus and vertex ferruginous; occiput ferruginous, black within and slightly beyond occiptal carina; genae ferruginous. Mandibles ferruginous with distal half black. Scape and pedicel ferruginous; flagellomere I ferruginous with a fuscous stain above distally; apical flagellomere ferruginous at apex and along ventral surface; remainder of flagellum fuscous.

Mesosoma black and ferruginous marked with whitish yellow; pronotum ferruginous shading to black anteriorly, spot on pronotal lobe whitish yellow; scutum ferruginous laterally, posterior margin and much of disk black nearly surrounding a pair of lanceolate, ferruginous

spots; scutellum ferruginous, lateral declivities darker; metanotum ferruginous; propodeum, metapleura, and metasternum black; mesopleura mostly black with spot behind pronotal lobe and lobes between mesocoxae ferruginous. Tegulae and axillary sclerites ferruginous. Wings subhyaline tinged with dark amber, slightly smoky; marginal cell with anterior half infumate; veins ferruginous, costal vein darker distally, almost brown. Coxae and trochanters black distally shading to ferruginous on lower surface; femora ferruginous with small amount of black basally; remainder of leg ferruginous; claws dark apically.

Gaster black and ferruginous marked with whitish yellow. Terga I to V with lateral whitish yellow spots, those on tergum I subcircular, those on tergum II ovate, and those on succeeding terga progressively narrower; lateral spots widely separated medially on tergum I and progressively closer together, but not joined medially, on succeeding terga; remainder of dorsal surface of gaster black except for ferruginous area between lateral spots on tergum I. Sterna black, narrowly ferruginous along apical margin of sternum I; sterna III and IV with widely separated, subcircular spots, spots larger on sternum III than on sternum IV. Genitalia brown, clearly darker than in *S. texanus*.

Allotype female: Similar to male; length 27 mm.

Structure. Difficult to distinguish from *S. texanus*. Clypeus somewhat more rugose medially above apical margin and lamellate apical border wider than in *S. texanus*. Dorsal ridge of pronotum with median indentation deeper than in *S. texanus*. Bulge in metapleuron adjacent to insertion of hindwing with two strong transverse carinae in *S. texanus*, and with lower carina poorly developed in *S. aztecus*. Ridge along lower margin of propodeum from midcoxa to bulge at base of hindcoxa carinate and extending onto bulge in *S. texanus*, and more rounded and not extending onto bulge in *S. aztecus*. This ridge forms lower margin of a triangular enclosure bordered above by a ridge extending from metapleuron to bulge at base of hindcoxa. The upper ridge is simply carinate in *S. texanus*, and in *S. aztecus* it is lower, broader, and (usually) bicarinate anteriorly. Width across pronotal lobes 6.5 mm. Forewing length 20 mm.

Vestiture. As in *S. brevipennis*.

Color. As in holotype male with the following differences. *Head* with supraantennal area ferruginous without black spots; area within occipital carina partly ferruginous, black not extending beyond carina. *Mesosoma* predominantly ferruginous; pronotum with black reduced to two small areas on each side, dorsal margin narrowly whitish yellow; scutum ferruginous except for narrow black area along median third of anterior margin; propodeum ferruginous with black restricted to line along anterior margin, most of lateral surface, posterior apex of enclosure, and lower margin of posterior face; metapleuron black with central ferruginous spot; mesopleuron ferruginous over most of lateral surface and along midline below with most of ventral surface and along sutures black, coxae and trochanters more extensively ferruginous.

Gaster with ferruginous more extensive; terga I to IV partly ferruginous; sterna II and III largely ferruginous, sterna IV and V less extensively so.

Variation: The paratypes agree in most respects with the description of the holotype but exhibit considerable variation in color and size. Color variation is much the same in the two sexes, and there is no consistent color dimorphism. The most striking variation concerns the relative extent of black and ferruginous. The lightest individuals approximate the condition in the allotype female, and the darkest individuals differ from the holotype as follows: Head with black extending from antennal sockets to vertex forming a band of width subequal to distance between the outer margins of the antennal sockets; occiput

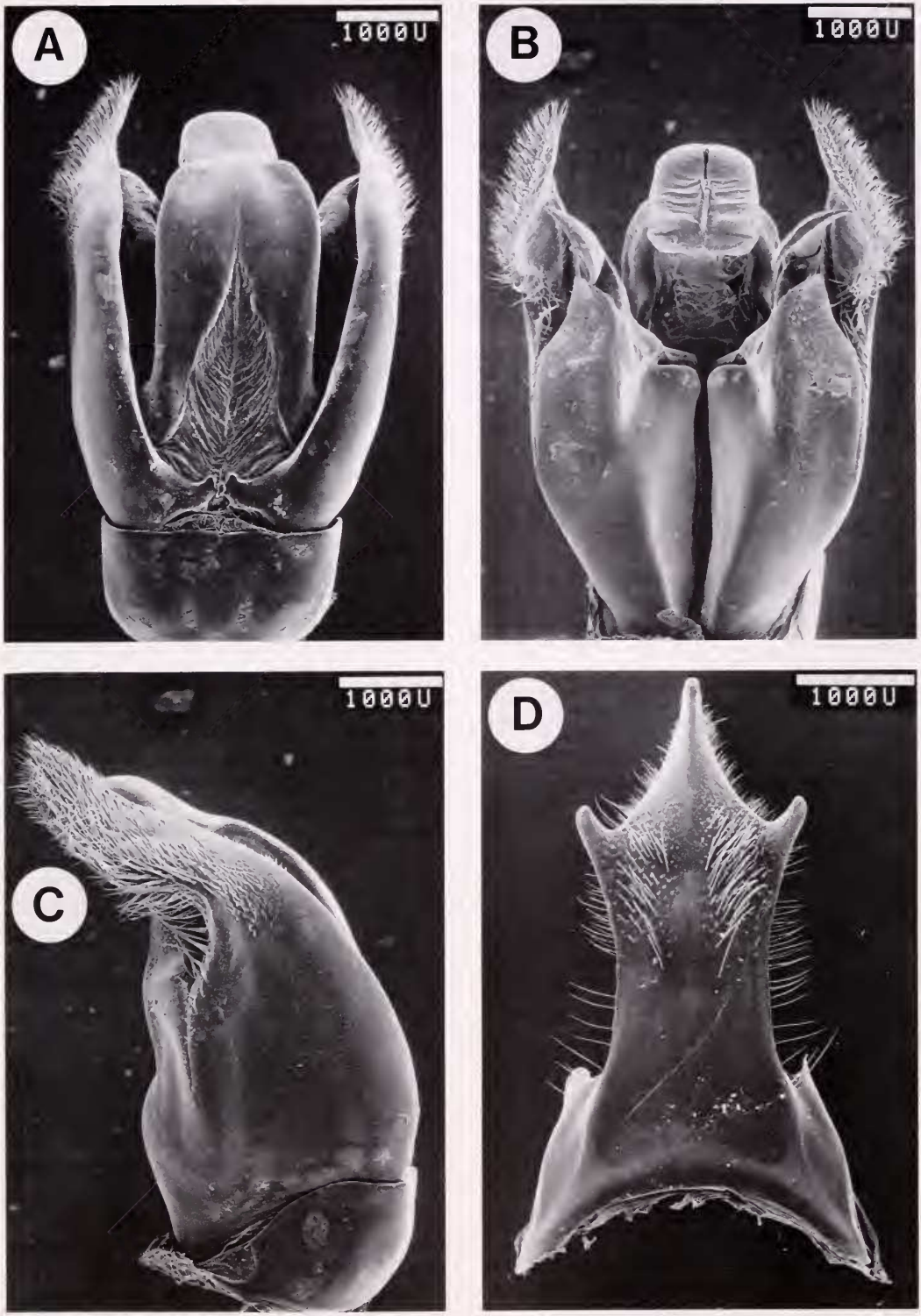

Figure 4. *Stizus aztecus,* new species. Male genitalia in A. dorsal, B. ventral, and C. lateral views; D. male sternum VIII, ventral view.

with black extending well beyond occipital carina and joining band extending from the antennal sockets. Mesosoma black with ferruginous much reduced; pronotum black, narrowly ferruginous along borders; scutum mostly black, ferruginous along lateral margins; scutellum mostly ferruginous, black laterally and along sutures; propodeum, metapleuron, and mesopleuron entirely black; coxae and trochanters almost entirely black; femora partly black, especially on hind legs. Gaster with background black, virtually without ferruginous. There is also considerable variation in the size of the whitish yellow maculations, and those on the sterna are sometimes virtually absent. The holotype is unique in lacking a band of whitish yellow along the dorsal margin of the pronotum. Unlike *S. texanus*, none of the available specimens of *S. aztecus* have any yellow on the scutellum. Male dimensions are: length 28 to 33 mm, width across pronotal lobes 6.5 to 8 mm, and forewing length 21 to 23 mm; the equivalent measurements for females are 26 to 28 mm, 6 to 7.5 mm, and 19.5 to 22 mm, respectively.

Types: Holotype male and allotype female, collected IX-22-1955 by G. E. Bohart on *Baccharis glutinosa* in Bisbee, Cochise Co., Arizona, to be deposited in the collection of the University of California at Davis. Paratypes, 4 males and 3 females, as follows:

CHIHUAHUA, MEXICO: 2 miles SE Temoris (actually Temores according to maps I have consulted, a town about 200 miles west of Hidalgo del Parral), ♂, 2 ♀, IX-11-1969 (T. A. Sears, R. C. Gardner, C. S. Glaser, UCD, JWS).

NAYARIT, MEXICO: Tepic, ♀, VIII-22-1905 (P. H. Goldsmith, MCZ). 25 miles NW Tepic, ♂, X-8-1950 (R. F. Smith, AMNH).

The two remaining male paratypes were purchased years ago by R. M. Bohart (personal communication) from the H. S. Gentry collection and bear the confusing locality record: "Mesa Col[orada?]. Son. Chih." I have been able to locate two settlements bearing the name Mesa Colorado (26°54'N, 108°14'W and 27°56'N, 108°38'W) both within the boundaries of Chihuahua and both within the region delimited by other localities where *S. aztecus* has been collected. It is probable that the specimens come from one or the other of these two places. Both specimens are in the UCD collection; one bears the date VIII-25-1933 and the other X-20-1933.

Remarks: *Stizus aztecus* is very closely related to *S. texanus*, but the genitalic differences are striking and constant. The females of the two species are difficult to separate on structural grounds, and the differences cited above may prove inadequate when more material becomes available. Similarly, the color of the scutellum which I rely on to separate females in the key may also prove inadequate. It should be noted, however, that the two species are strikingly different in color in Chihuahua and southeastern Arizona where they occur in close proximity. *S. aztecus* is marked with whitish yellow on a very dark, mostly black, background while western individuals of *S. texanus* are much more extensively marked with a deeper shade of yellow on an almost entirely ferruginous background. Darker individuals of *S. texanus* from more eastern localities are more difficult to distinguish from *S. aztecus*, but this problem should not arise in practice. It may also be noted that the two species appear to have different ecological requirements, and no cases of local sympatry are now known. *S. aztecus* is a montane form apparently restricted to the Sierra Madre Occidental and its outliers while *S. texanus* is largely a lowland form occurring east of the Mexican cordillera and north to Oklahoma and southeastern Arkansas with a western extension into the lowlands of southeastern Arizona.

Stizus occidentalis Parker

1929 *Stizus occidentalis* Parker, Proc. U.S. Nat. Mus. **75**(5): 9–10, pl. 4, fig. 29.

1942 *Stizus occidentalis* Parker. Dow, Psyche, **48**: 176, figs. 2, 4.

1943 *Stizus occidentalis* Parker. Lohrmann, Mitt. Munchn. Ent. Ges. **33:** 195.

Male: Length 16 to 21 mm.

Structure. Head in facial view with posterior ocelli distinctly projecting above the nearly straight vertex. Clypeus emarginate apically, posterior margin nearly straight. Antennal sockets separated from eyes by somewhat less and from each other by somewhat more than their transverse diameter; space between antennal sockets with a low ridge, carinate posteriorly. Median frontal depression narrower than in *S. iridis*, not surrounding anterior ocellus; lateral margin of each posterior ocellus bordered by a longitudinal, shining impression about one third the diameter of the ocellus in width and extending posteriorly for a distance about equal to the diameter of the ocellus but not descending the vertical face of the occiput. Flagellomeres VII to X much shorter than the four preceding; apical flagellomere rather variable in shape, apex evenly rounded to obliquely truncate when viewed from the direction of the tyloidal surface; linear tyloids present on flagellomeres V to XI, that on apical flagellomere longer than in *S. iridis*, usually more than half as long as the flagellomere.

Mesosoma in dorsal view more rounded anteriorly and more pointed behind than in *S. iridis*; width across pronotal lobes 4.5 to 5.5 mm; parapsidal furrows not extending to posterior margin of scutum, represented by simple impressed lines; oblique scutal carina present, delimiting a posterolateral declivity nearly at the posterior margin of the scutum, declivity almost vertical with posterior margin only slightly produced into a lobe; posterior angles of propodeum not as convex as in *S. iridis*; propodeum without a pair of carinae on lower posterior face. Forewing length 13.5 to 16 mm; first transverse cubital vein nearly straight. Legs not as slender as in *S. iridis*; foretarsal rake poorly developed.

Gaster somewhat more inflated than in *S. iridis*; tergum I with convex sides as seen from above, distinctly rounded anteriorly in dorsal aspect, and with a less sharply marked anterior face than in *S. iridis*; sternum VII with a prominent longitudinal carina on the inner surface extending from the basal carina for about three fourths the length of the sternum; sternum VIII as shown in Figure 5; median prong not as long as in *S. iridis*. Genitalia as in Figure 5; compressed shaft of digitus in lateral view about the same width throughout; cuspides long and slender, rounded apically; parameres exceeding aedeagus by less than length of apical enlargement of aedeagus.

Vestiture. Conspicuous pale hairs up to four midocellus diameters in length on vertex, lower genae, mesosoma, and tergum I, but shorter and often not as dense on remainder of body. Coxae, trochanters, and femora with erect hairs. Short, appressed pubescence restricted to legs, tegulae, sclerites at base of wings, and the larger veins of both wings. Membranes of both wings with widely spaced setae, these much sparser than in *S. iridis*, denser near the anterior margins, absent from posterior portions of first and second submarginal cells and from most of the median cell of the hindwing.

Color. Black and ferruginous, extensively marked with yellow.

Head black marked with yellow; labrum, clypeus, supraclypeal area except for dark stains marking tentorial pits, and inner orbits to level of midocellus all yellow. Upper frons (between antennal sockets and midocellus) with yellow of variable extent; typically, a pair of black spots present above antennae, these usually joined medially and extending upward to black area above midocellus and thereby surrounding a pair of crescent-shaped yellow spots separated medially by a narrow wedge of black extending downward from midocellus; occasionally, the supra-antennal black spots completely surrounded by yellow and rarely the upper frons entirely black except for the inner orbits. Scape yellow with a black spot above and usu-

ally tinged with ferruginous, especially above. Flagellum fuscous and orange-ferruginous; flagellomeres I to III and XI usually all or mostly orange-ferruginous and others fuscous, occasionally the orange more extensive, sometimes extending to lower surface of all flagellomeres and, in other cases, fuscous more extensive, extending to the dorsal surface of all flagellomeres. Postocular stripe always present, yellow, narrower above, and separated from eye by a narrow black line. Mandibles yellow, dark apically. Labial and maxillary palpi yellow, more or less suffused with ferruginous. Compound eyes pale brown.

Mesosoma mostly black. Pronotum yellow, black anteriorly; anterior black area often with a pair of rectangular posterior projections above; black spot present near each pronotal lobe, this usually connected both above and below to the anterior black area. Scutum black with yellow-ferruginous lateral margins. Tegulae and base of wings ferruginous. Scutellum black, usually with lateral semicircular yellow spots narrowly separated medially, spots sometimes joined medially, yellow occasionally absent. Metanotum often entirely black, sometimes with lateral oblong yellow spots which occasionally meet medially. Mesopleuron with a small yellow spot near pronotal lobe, this spot sometimes inconspicuous or absent. Legs mostly yellow, more or less suffused with ferruginous especially at the joints between segments; coxae black with a variable amount of ferruginous ventrally and distally; trochanters ferruginous, sometimes black basally; femora ferruginous, usually more or less yellow beneath; claws dark apically. Forewing with marginal cell strongly infumate, darker in the anterior half; central portion of forewing suffused with amber, basal and distal portions clear; entire hindwing clear; veins of both wings ferruginous, those surrounding marginal cell darker, almost brown.

Gaster mostly yellow with black and ferruginous markings. Anterior face of tergum I black, often more or less replaced with ferruginous along posterior margin, and usually with three posterior extensions. Anterior margin of each succeeding tergum black, sometimes more or less replaced with ferruginous, with a medial triangular extension sometimes extending to the apical margin as a faint line. Terga I to VI with apical translucent ferruginous bands, these sometimes narrowly interrupted medially. Tergum VII extensively black anteriorly with an apical yellow band narrowly bordered with ferruginous; spiracular lobes black with a rather broad partially transparent yellow margin apically and ventrally. Sterna I to VI black basally, often more or less extensively replaced with ferruginous; black area with rounded triangular posterior extension medially, this more or less continuous with translucent ferruginous apical bands and thus more or less distinctly defining the medial borders of a pair of lateral yellow spots, except on sternum I which is extensively ferruginous and without yellow. Sternum VII black basally and extensively ferruginous apically. Sternum VIII dark brown basally with ferruginous prongs. Genitalia more heavily pigmented than in *S. iridis*, brown.

Female: Similar to male, usually larger, length 16 to 21 mm.

Structure. As in male aside from the usual sexual differences and the following exceptions: antennae without tyloids; width across pronotal lobes 4.5 to 6 mm; forewing length 13 to 17 mm; foreleg with well-developed foretarsal rake. Apical tergum without a pygidial plate.

Vestiture. As in male.

Color. Similar to male; yellow areas usually more extensive and black areas often replaced with ferruginous; black spots above antennae smaller, not joined medially, and not extending to black area on vertex; antennae more extensively orange-ferruginous, fuscous restricted to dorsal portions of pedicel and flagellomeres V to VII or less; black on pronotum often much reduced; scutellum mostly

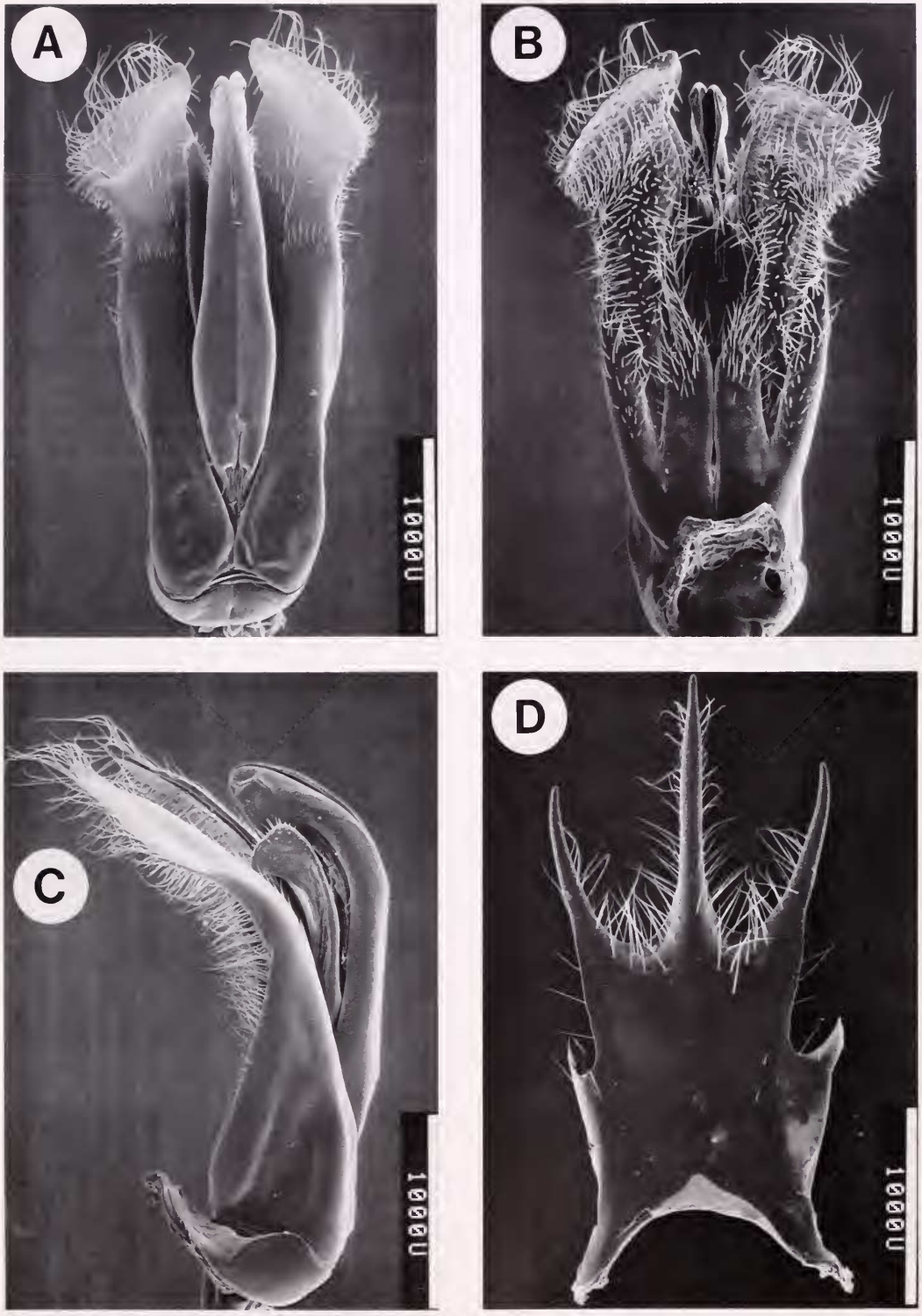

Figure 5. *Stizus occidentalis* Parker. Male genitalia in A. dorsal, B. ventral, and C. lateral views; D. male sternum VIII, ventral view.

yellow; spots of yellow or ferruginous on posterior face of propodeum sometimes present.

Types: Holotype male Cat. No. 40847, U.S. National Museum. Allotype female in the collection of the Philadelphia Academy of Natural Sciences.

Type Locality: "Described from two specimens, a male from San Diego County, California, collected by Mr. Coquillett, and a female from Florence, Arizona" (Parker, 1929). Dow (1942) has suggested that the holotype male "may really have been taken in what is now Imperial County, formerly the eastern part of San Diego County." In any event, *S. occidentalis* is now known from both San Diego and Imperial Counties.

Distribution: *Stizus occidentalis* has previously been recorded from California and Arizona, and the range is here extended to include southern Nevada and Utah. Floral records include *Acacia*, *Dalea*, *Pluchea*, *Prosopis*, *Sarcostemma*, and *Tamarix*. Collection dates range from March to July. I have examined the following specimens, 84 males and 42 females:

ARIZONA: *Coconino Co.*: Grand Canyon, Mile 52, ♂, VI-6-1953 (G. D. Butler, USNM). Grand Canyon National Park, 15 mi NE Phantom Ranch, ♂, V-1-1968 (J. E. Slansky, UCD). *Mojave Co.*: Cattail Cove, 9 mi N Parker Dam, ♂, IV-7-1972, on flowers of *Tamarix gallica* (B. Apperson, BBSL). Lake Havasu City, ♀, IV-28-1972 (P. Torchio, G. Bohart, and F. Parker, BBSL). *Maricopa Co.*: Gila Bend, 18 mi S, ♂, V-8-1965, on flowers of *Prosopis glandulosa* Torr. (M. A. Mortenson, J. M. Davidson, and M. A. Cazier, UCD). *Pima Co.*: Ajo, 3 mi S, ♂, IV-22-1966, at flowers of *Prosopis* (Torchio, Rust, and Yousef, BBSL). *Pinal Co.*: Florence, allotype ♀, V-20-1903 (PAS). *Yuma Co.*: Yuma, 45 mi N, ♀, IV-5-1972 (W. Apperson, BBSL).

CALIFORNIA: *Imperial Co.*: Glamis, on dunes, ♂, IV-20-1978 (J. W. Stubblefield, JWS). *Inyo Co.*: Ballarat, ♂, III-26-1961 (D. R. Miller, UCD); ♂, ♀, III-27-1972, on flowers of *Prosopis glandulosa* Torr. (J. D. Pinto, UCR). Darwin Falls, ♀, V-8-1958 (R. M. Bohart, UCD); 5 ♂, V-8-1958 (A. E. Menke, UCD); ♂, V-8-1958 (A. E. Menke, LACM); ♀, V-8-1958 (L. A. Stange, UCD); ♀, V-6-1961 (F. D. Parker, UCD); ♂, V-21-1965 (A. S. Menke, UCD); 7 ♂, IV-9-1972 (G. E. Bohart, UCD). Death Valley Junction, 3 mi W, ♂, V-17-1970 (R. M. Bohart, UCD). Furnace Creek, Death Valley, ♂, III-25-1961 (V. L. Vesterby, UCD). Grotto Canyon, Death Valley, 2 ♂, ♀, IV-22, 23-1976 on flowers of *Sarcostemma hirtellum* (Gray) (J. W. Stubblefield, JWS). Mormon Hill, Death Valley, 3 ♂, III-25-1961 (V. L. Vesterby, UCD); 4 ♂, III-29-1961 (M. E. Irwin, UCD). Panamint Mountains, ♂, V-28-1937 (C. D. Michener, MCZ); 2 ♀, V-29-1937 (N. W. Frazier, MCZ). Panamint Valley, 3 ♀, V-1, 2-1976 (J. W. Stubblefield, JWS). Post Office Spring (near Ballarat), 1,080 ft, ♀, IV-9-1972, on flowers of *Prosopis glandulosa* Torr. (J. W. Stubblefield, JWS). Saline Valley, Morning Sun Mill Site, ♀, IV-21-1973 (G. W. Akin, JWS). Saratoga Spring, Death Valley, 2 ♂, III-30-1956 (Belkin and MacDonald, LACM); 2 ♂, III-29-1961 (R. D. Nelson, LACM); 2 ♂, 2 ♀, III-30-1961 (D. R. Miller, UCD); ♂, ♀, III-30-1961 (V. L. Vesterby, UCD); ♀, V-20-1965 (A. S. Menke, L. A. Stange, UCD). Stovepipe Wells, on nearby dunes, ♀, IV-23-1976, on flowers of *Prosopis glandulosa* Torr. (J. W. Stubblefield, JWS). Surprise Canyon, Panamint Mts., 10 ♂, 7 ♀, V-9-1958 (R. M. Bohart, UCD); 5 ♂, ♀, V-9-1958 (A. E. Menke, UCD); ♀, V-9-1958 (A. E. Menke, LACM); 4 ♂, ♀, V-9-1958 (L. A. Stange, UCD); 3 ♂, V-9-1958 (M. A. Stange, UCD). Wild Rose, Panamint Mts., ♀, V-20-1937 (UCD). *San Bernardino Co.*: Cronise Valley, 3 ♀, V-5-1960 (F. D. Parker, UCD). Salt Creek (north of Baker), ♀, V-7-1973, on flowers of *Prosopis glandulosa* Torr. (J. W. Stubblefield, JWS); 2 ♂, V-7-1973, on flowers of *Tamarix* (J. W. Stubblefield, JWS); 3 ♀, IV-23, 24-1976, on flowers of *Prosopis glandulosa* Torr. (J. W. Stubblefield, JWS); 2 ♀, IV-23-1978, on flowers of *Prosopis glandulosa* Torr. (J. W. Stubblefield, JWS). *San Diego Co.*: Borrego, ♂, IV-20-1951 (C. D. MacNeill, MCZ).

NEVADA: *Clark Co.*: Glendale, 20 mi W, ♀, VI-2-1973 (P. F. Torchio, BBSL); 2 ♂, IV-29-1975 (F. Parker and P. Torchio, BBSL). Moapa, 7 mi NW, ♂, on flowers of *Prosopis* (R. C. Bechtel, USNM). Valley of Fire, ♂, IV-29-1982, at flowers of *Dalea* (P. F. Torchio, BBSL).

UTAH: *Emery Co.*: Buckskin Spring N of Goblin Valley, 5,100 ft, ♂, VI-14-1983 (T. L. Griswold, BBSL); 3 ♂, VI-15-1983, at flowers of *Tamarix* (J. W. Stubblefield, JWS). North Temple Wash, San Rafael Desert, 5,100 ft, ♂, VI-15-1983, at flowers of Tamarix (J. W. Stubblefield, JWS). Wild Horse Creek N of Goblin Valley, 4,900 ft, ♂, VII-25 to 28–1983 (F. D. Parker and T. L. Griswold, BBSL). Woman Wash, San Rafael Desert, 5,000 ft, 4 ♂, VI-15-1983 (T. L. Griswold, BBSL); 3 ♂, (J. W. Stubblefield, JWS). *Washington Co.*: St. George, ♀, VI-23-1961 (G. F. Knowlton, UCD).

Remarks: *Stizus occidentalis* is closely related to *S. iridis* but is easily separated by its mostly black mesosoma. Both are desert species and inhabit similar ranges, but *S. occidentalis* flies earlier in the year and mostly at lower elevations than *S. iri-*

dis. *S. occidentalis* is by far the most frequently collected western species and is often common about the flowers of *Prosopis* during March, April, and May in the Death Valley region of eastern California.

Stizus iridis Dow

1942 *Stizus iridis* Dow, Psyche **48:** 171–176, 180 (key), figs. 1, 3, 5. ♂.
1976 *Stizus iridis* Dow. Dow, Proc. Ent. Soc. Washington, **78:** 65–66. Nest and prey.

The following description has been extensively modified from Dow (1941) in order to include additional characters and such variation as I have observed. A description of the female appears here for the first time.

Male: Length 20 to 25 mm.

Structure. Head in facial view with the lateral ocelli clearly projecting above the nearly straight vertex. Compound eyes nearest to each other where they meet the clypeus. Clypeus emarginate anteriorly and distinctly but shallowly so posteriorly; supra-clypeal area posteriorly about three times as broad as long. Antennal sockets separated from the compound eyes and from each other by somewhat less than their transverse diameter; space between antennal sockets with a low ridge, more or less carinate posteriorly. Median frontal depression broad, surrounding anterior ocellus; lateral ocelli separated from the eyes by one and one half times their diameter, and from each other by twice their diameter: posterolateral margin of each lateral ocellus bordered by an impressed line which continues posteriorly in a medially concave curve to the vertical face of the occiput. Flagellomeres VII to X much shorter than the four preceding; flagellomere VII about two-thirds as long as VI; apical flagellomere tapering to a rounded apex and not emarginate within: tyloids present as linear carinae on flagellomeres IV to XI, that on III very short, practically a tubercle.

Mesosoma more angulate anteriorly and broader behind in dorsal view than in *S. occidentalis*; width across pronotal lobes 6 to 6.5 mm. Parapsidal lines not extending to the posterior margin of the scutum, each represented by a very slender carina beside an extremely fine impression; oblique scutal carina present, delimiting a posterolateral declivity distinctly anterior to posterior margin of scutum, declivity largely horizontal with posterior margin produced into a distinct lobe. Propodeum without a pair of carinae on lower posterior face. Forewing length 17 to 18 mm; first transverse cubital vein practically straight. Legs more slender than in *S. occidentalis*; foretarsal rake poorly developed.

Gaster with tergum I flattened anteriorly, roundly angulate anteriorly in dorsal aspect, the concave sides parallel towards base as seen from above, diverging posteriorly. Sternum VII with a prominent median longitudinal carina on the inner surface extending from the basal carina for about three fourths the length of the sternum, visible externally as a fine ferruginous line; sternum VIII as in Figure 6, median prong longer than in *S. occidentalis*. Genitalia as in Figure 6; compressed shaft of digitus in lateral view strongly emarginate on ventral margin; cuspides long and slender, rounded apically; parameres exceeding apex of aedeagus by more than length of apical enlargement of aedeagus.

Vestiture. Shorter and less conspicuous than in *S. occidentalis*; pale hairs generally distributed, longer than elsewhere on posterior half of clypeus, sides of the supraclypeal area, anterior portion of supraantennal area, vertex and adjacent occiput, lower portions of genae, lower lateral and ventral portions of mesopleura, posterior angles of the propodeum, and tergum I. Appressed pubescence restricted to legs, tegulae, axillary sclerites, and larger veins of both wings. Membranes of both wings with numerous setae which tend to be denser near the costal margins, but absent from the posterior portion of the sec-

ond submarginal cell and adjacent portions of neighboring cells.

Color. Yellow marked with black and ferruginous.

Head yellow with the following exceptions: mandibles dark brown at apex with a ferruginous line along inner margin; a dark spot above each antenna, variable in size, often inconspicuous and sometimes absent; transverse black band on vertex, variable in width, sometimes shading to ferruginous laterally, sometimes not quite reaching compound eyes, sometimes with anterior pointed extensions laterally; a pair of black or ferruginous bands on occiput connecting sides of transverse band on vertex with an extensive black area surrounding occipital foramen, bands sometimes poorly developed or absent; ferruginous extensions of variable intensity extending posteriorly from lateral ocelli sometimes present. Antennae with scape above, pedicel, and flagellum ferruginous; flagellum shading to black above and to orange toward apex.

Mesosoma mostly yellow. Pronotum with a black transverse band anteriorly, sometimes shading to ferruginous laterally. Disk of scutum and anterior margin between pronotal lobes black, marked with two narrow yellowish longitudinal stripes, or two large spots of reddish brown, or various intermediate patterns, or simply black. Anterior margin of propodeum with a narrow black band, somewhat variable in width, and often with a pointed median extension: sutures of propodeum marked with black lines, sometimes partly obsolete, these meet on posterior surface at a black line extending upward along the median groove. Propleura ranging from black with a small yellow spot near forecoxa to mostly yellow. Ventral portion of mesopleura with a large dark spot, varying from black to partly or entirely ferruginous, often interrupted medially, rather variable in shape, narrowly separated posteriorly from a dark spot near ventral end of the meso-metapleural suture; remainder of mesopleura, except dorsally, suffused with orange of variable intensity. Meso-metapleural and metapleural-propodeal sutures marked with black lines. Metasternum yellow with black markings of variable shape and extent. All coxae black basally, at least anteriorly, sometimes shading to ferruginous; remainder of legs partly suffused with orange. Forewing with veins and membrane yellowish basally, and somewhat ferruginous in the region of the first submarginal and marginal cells, the latter with a dark streak in the anterior half; hindwing yellowish.

Gaster mostly yellow; tergum I with anterior face more or less ferruginous, with a black basal portion usually with a narrow median projection and broad lateral extensions, sometimes lateral or median extensions poorly developed or absent; apical and to some extent lateral margins of all terga orange; basal margins of terga II to V orange or black (always black on terga IV and V) each with a triangular median extension of the same color. Sterna variously marked with orange and black. Genitalia yellowish.

Female: Similar to male, usually larger, length 21 to 28 mm.

Structure. As in male, aside from the usual sexual differences and the following exceptions: supraclypeal area relatively shorter; compound eyes nearest to each other above the clypeus, antennae without tyloids; foretarsal rake well developed. Width across pronotal lobes 6 to 6.5 mm; forewing length 18 to 21 mm. Apical tergum without pygidial plate.

Vestiture. As in male.

Color. As in male with the following exceptions: black on vertex sometimes replaced with ferruginous, lateral margins usually ferruginous; black area surrounding occipital foramen reduced, lateral connections with vertex absent, faint posterior projections from lateral ocelli sometimes present; flagellum more extensively orange, sometimes entirely so; scutum

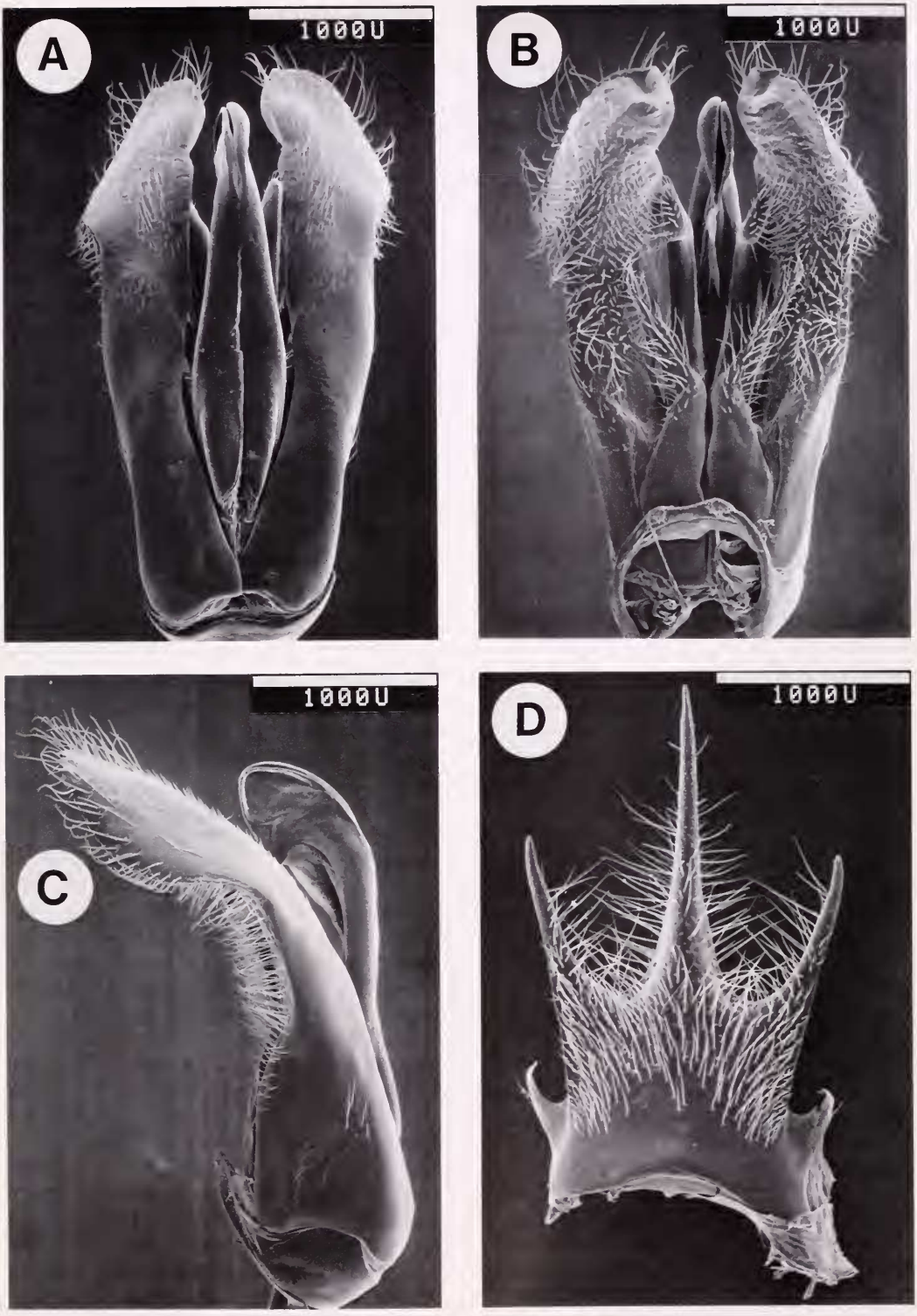

Figure 6. *Stizus iridis* Dow. Male genitalia in A. dorsal, B. ventral, and C. lateral views; D. male sternum VIII, ventral view.

never entirely black; propleura more extensively yellow, black sometimes replaced with ferruginous; mesopleura with black much reduced or absent, often entire ventral portion suffused with orange; black lines marking meso-metapleural and metapleural-propodeal sutures sometimes partially obsolete; black of metasternum replaced with ferruginous; dark streak in anterior half of marginal cell occasionally not evident; black area of tergum I often much reduced; black on sterna often reduced or absent.

Types: Male holotype No. 23397 and male paratype in the Museum of Comparative Zoology, Harvard University. One male paratype, No. 55828, in the U.S. National Museum.

Type Locality: Cited as Rainbow Bridge National Monument, San Juan County, Utah in Dow (1942) and the types bear this locality. Dow (1976), however, relocated the type locality and found it to be on the Navajo Indian Reservation one half mile NNE of Rainbow Bridge, clearly beyond the boundaries of the National Monument.

Distribution: *Stizus iridis* has been previously recorded only from the type locality in Utah, and the range is here extended to include portions of Arizona and California. Collection dates range from July to September, and floral records include the genera *Asclepias*, *Clematis*, *Melilotus*, and *Tamarix*.

I have examined the following specimens, 11 males and 7 females:

ARIZONA: *Coconino Co.*: Cliff Dwellers Lodge, ♂, VII-8-1967, on flowers of *Tamarix pentandra* Pall (J. H. Davidson, J. M. Davidson, M. A. Cazier, UCD).

CALIFORNIA: *Inyo Co.*: Antelope Spring, ♀, VII-16-1960 (H. K. Court, UCD); ♀, VIII-11-1960 (H. K. Court, UCD). Bishop, 15 mi N, ♂, VIII-5-1948 (P. D. Hurd and J. W. MacSwain, MCZ). Limekiln Spring, Surprise Canyon, 4,000 ft, ♂, VII-5-1971, on flowers of *Melilotus albus* Desr. (J. W. Stubblefield, JWS). Narrows of Surprise Canyon, 3,600 ft, ♀, VIII-9-1971, on flowers of *Melilotus albus* Desr. (J. W. Stubblefield, JWS). Slaughterhouse Spring (in Panamint City), 6,400 ft, 2 ♂, VII-26-1971, on flowers of *Clematis ligusticifolia* (J. W. Stubblefield, JWS); ♂, VII-26-1971, on flowers of *Asclepias fascicularis* Dcne. in A. DC. (J. W. Stubblefield, JWS); ♂, VII-30-1971, on flowers of *Clematis ligusticifolia* (J. W. Stubblefield, UCD); ♀, VII-30-1971, on flowers of *Clematis ligusticifolia* (J. W. Stubblefield, JWS). Spring above Thompson Camp, Panamint Mts. (upper Surprise Canyon, actually Water Canyon), 6,800 ft, ♀, VII-22-1971 (J. W. Stubblefield, JWS). *San Diego Co.*: Julian, ♀, VII-4-1962 (J. H. Froebe, UCD).

UTAH: *Emery Co.*: Capitol Reef, E edge, ♀, IX-15-1979 (F. Parker and D. Veirs, BBSL). Goblin Valley State Reserve, 2 mi N, 5,000 ft, ♂, VIII-25-1982 (A. S. Menke, K. A. Menke, and F. D. Parker). Little Gilsen Butte, 5,000 to 5,100 ft, ♂, VIII-24 to 27-1980 (F. D. Parker and T. L. Griswold, BBSL); 2 mi E, 5,100 ft, ♂, ♀, VIII-24 to 26-1981 (Veirs, Griswold, and Parker, BBSL). Wild Horse Creek N of Goblin Valley, 4,900 ft, ♂, VII-23-1982 (Parker and Griswold, BBSL); ♀, 3 ♂, VII-25 to 28-1983 (Parker and Griswold, BBSL); 4,800 ft, ♂, ♀, VII-26 to 28-1982 (Parker and Griswold, BBSL). *San Juan Co.*: Rainbow Bridge National Monument, 3 ♂, VII-16-1935 (C. T. Brues, holotype No. 23397 and paratype, MCZ; paratype No. 55828, USNM).

Remarks: *Stizus iridis* is closely related to *S. occidentalis* but differs from that species in a number of details and can be immediately recognized by its much more extensive yellow coloration. The two species are ecologically quite distinct. In Inyo Co., California, where I have observed both species in the field, *S. iridis* is a summer species of desert mountain ranges, while *S. occidentalis* is a vernal species of the surrounding valleys. The two species are locally sympatric in the San Rafael Desert of Utah where they have been collected together in late July. Aside from this remarkably late record for *S. occidentalis*, collection dates for *S. occidentalis* range from March to June, while those for *S. iridis* range from July to September. The nesting biology of *S. occidentalis* remains unknown, but Dow (1976) has reported on two active nests of *S. iridis*. Both nests consisted of a sloping tunnel terminating in a single cell stocked with adult acridids of the genus *Trimerotropis*.

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